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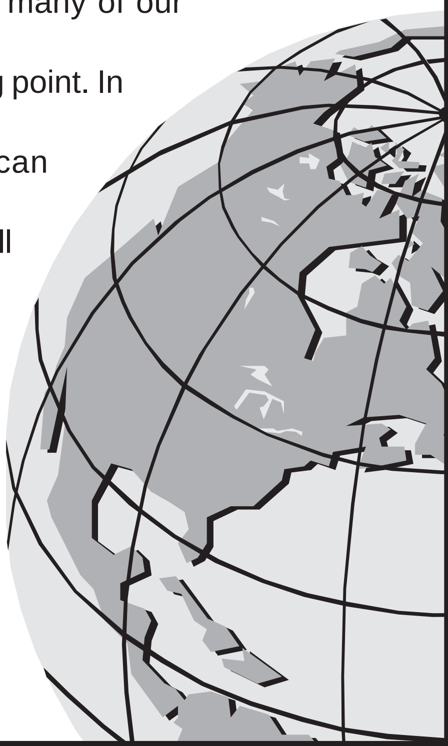
Special Feature

A New Global Vision for Support

combat support command and control

Today, we find ourselves deployed to global places, many on short notice, and as a result, many of our resources are stretched to their breaking point. In this new environment, we no longer can afford to manage in stovepipes; rather, all combat support must be managed in unison to create the desired operational effects.



Introduction | Lieutenant General Michael E. Zettler, USAF

the new Vision

For the last 7 years, the Air Force, in response to ever-changing geopolitical events, has been working toward becoming a more expeditionary force. We have shifted from a Cold War-based system, where we concentrated on certain enemies and planned with great detail the type and nature of any conflict, to a much more flexible and responsive force. During the Cold War era, we prepositioned massive amounts of combat support (CS) at bases and in theaters. Much of that support was managed by commodity or type. Today, we find ourselves deployed to global places, many on short notice, and as a result, many of our resources are stretched to their breaking point. In this new environment, we can no longer afford to manage in stovepipes; rather, all combat support must be managed in unison to create desired operational effects.

All combat support must be managed in unison to create desired operational effects. We must be ready to measure actual performance constantly against planned performance and adjust accordingly.

We must understand the impact that any one resource or subsystem can have on the entire system. This overarching global view is essential for enabling today's air and space expeditionary force. For the last couple of years, Air Force people in both the operations and CS communities have worked with and led RAND Project Air Force analysts to define our current combat support command and control (CSC2) AS-IS state and develop a TO-BE operational architecture. Because the Air Force operates in a dynamic environment, defining the AS-IS state is valid only for that moment in time. However, our recognition and understanding of the processes and disconnects in the current system facilitated the definition and boundaries of the TO-BE vision. Once defined, the vision provides us a roadmap as we move forward.

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The cornerstone of our TO-BE vision is a global view of combat support. While there is a requirement for the A-4 or J-4 staffs to maintain much of the operational control, there is also a requirement for resource allocation arbitration above the engaged component command. As an example of this requirement, I would like to describe the world, from the Air Force point of view, shortly after 11 September 2001. We had combat forces deployed in support of Operations Northern and Southern Watch supporting the no-fly zones in Iraq. Additionally, we were building up forces in support of Operation Enduring Freedom in Afghanistan. At the same time, many continental United States-based forces—including the Air Force Reserve Command, Air National Guard, and active-duty Air Force bases—were flying in support of Operation Noble Eagle. Concurrently, we continued our day-to-day vigilance over the skies of South Korea. Arguably, any of these missions could be seen as a top priority. However, when everything is priority one, nothing is priority one. Compounding the problem of the number of missions was the fact they crossed all major commands. Our vision puts in place standing organizations that can deal with these complex issues.

First and foremost, combat support must be aligned closely with operations, both in planning and at execution. Operations cannot achieve the capability and desired effects without adequate combat support. Nor can the supporter provide required resources without a thorough understanding of the requirement. While this explanation may seem contrite and obvious to some, when we examined the current C2 system, we found disconnects that created misunderstanding. Our implementation plan is designed to eliminate as many disconnects as possible.

CS systems need feedback loops and the ability to reconfigure an infrastructure to meet changing needs in a constantly

changing environment. While we continue to improve forecasting models, many factors cannot be modeled with desired accuracy. The major deterrent when computing requirements is not our inability to design consumption models but our inability to inject wartime factors—such as enemy actions, weather, and other variables—into the model. For this reason, we must be ready to measure actual performance constantly against planned performance and adjust accordingly. The vision provides for measuring and adjustment processes.

There is no such thing as an Air Force-centric CS system. We operate in a world supported by and supporting the other services, as well as coalition partners. In fact, some argue for a theater logistics commander reporting to the combatant commander who would control all logistics requirements for all services. While I do not advocate this, we must have a vision that provides the ability to understand and leverage the individual capabilities of each.

Finally, I should emphasize that one of the keys to achieving many of the successes the Air Force has enjoyed throughout its history has been our people. Energetic, adaptable, never tiring airmen are at the core of the Air Force. I argue flexibility is inherent in airpower, and many ad hoc organizations have been put together, most functioning with some measure of success because of the ingenuity of the airmen who ran those organizations. Our challenge has been to harness the best of these organizations, delete redundancy, and bridge disconnects. I believe the TO-BE operational architecture described in the following pages will do just that. There is always room for improvement, and I encourage each of you connected to the processes to review our vision with a critical eye. Help us move forward. This vision is intended as a roadmap to change. Adjustments will be required. As I stated earlier, we live in a dynamic world. With your help, we will continue to enable the Air Force to deliver the required capabilities to combatant commanders anywhere in the world.

Lieutenant General Zettler

Lieutenant General Michael E. Zettler is the Air Force Deputy Chief of Staff, Installations and Logistics. He is responsible for leadership, management, and integration of Air Force civil engineering, communications operations, services, logistics readiness, maintenance, and munitions policies and resourcing to enhance productivity and combat readiness while improving the quality of life for Air Force people.

He received his commission in July 1970 after completing the Air Force ROTC program as a distinguished graduate. He has held various assignments in the maintenance, logistics, and programming fields at the squadron, wing, center, major command, and Air Force headquarters levels and command positions at the squadron and wing levels.

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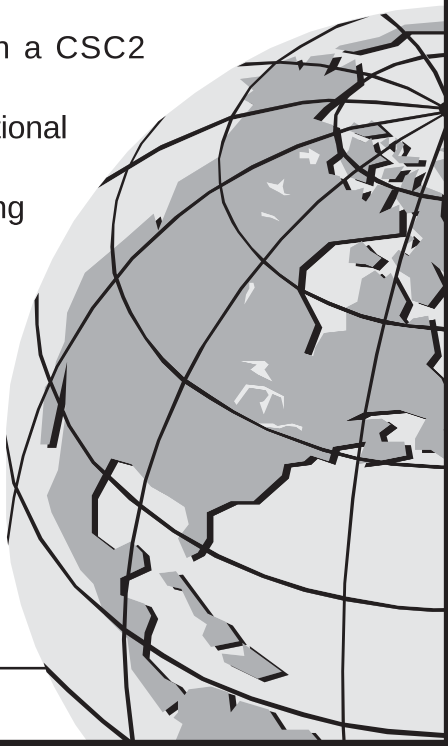
Moving from Concept to Reality

implementing the architecture

The responsiveness required by today's operational forces can be achieved better through a CSC2 construct that is focused on creating operational effects. CSC2 is a subset of the overarching command and control within the operational planning and execution process, developing integrated operations and CSC2 processes.



Concept to Reality

CSC2 concepts and an analysis of CSC2 processes drive an assessment of required changes in doctrine, training and education, materiel, leadership, and personnel.

Special Feature

As the Air Force transitions to a more expeditionary force, combat support command and control (CSC2) will have an essential role. The responsiveness required by today's operational forces can be achieved better through a CSC2 construct that is focused on creating operational effects. CSC2 is a subset of the overarching command and control (C2) within the operational planning and execution process, developing integrated operations and CSC2 processes. It is the means through which a designated commander plans, assesses, directs, and controls CS forces and resources to achieve operational effects. This article will lay the groundwork for taking the CSC2 operational architecture from a concept to a reality. The CSC2 concepts and an analysis of the required processes drive an assessment of required changes in doctrine, organization, training and education, materiel, leadership, and personnel (DOTMLP). Some of these changes are already underway and evolving from lessons learned in Operations Noble Anvil and Enduring Freedom.

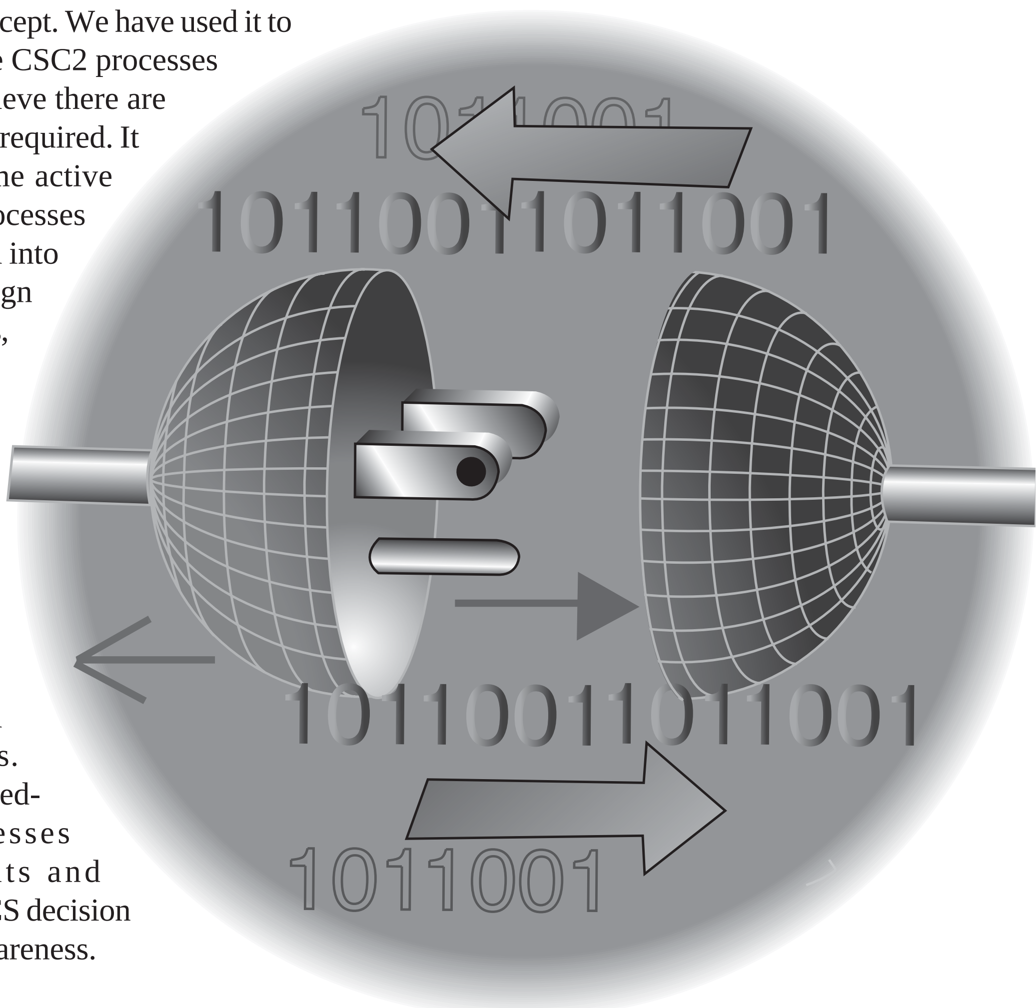
To implement this work in a constructive fashion, we have set up an implementation team that has been patterned after the approach taken in the Chief's Logistics Review and Spares Campaign. It will be their charge to take the operational architecture; solicit comments from Air Force component commands, Air Staff, and major commands (MAJCOM); and integrate lessons learned from previous and ongoing operations to develop and refine an executable implementation plan. This plan will be time phased and focus on specific objectives. There will be a roadmap with associated metrics to indicate current status and progress toward capability-based goals. We intend to assess the progress at regular milestones. Where appropriate, we will leverage Air Force-wide efforts in command and control and communicate the status to MAJCOM commanders and at Corona conferences. All Air Force elements will be informed of the CSC2 implementation plan. In this article, I will briefly outline some of the specifics of our plan.

Core process changes will serve as guiding principles for developing transition plans to implement a CSC2 operational architecture.

Changes in DOTMLP

The joint services framework for analyzing processes and implementing new concepts in both material and nonmaterial solutions has been applied to the CSC2 operational architecture. This framework, DOTMLP, is a tool to manage the evolutionary changes required to meet operational requirements and is designed to be a comprehensive assessment of all applicable aspects of the process or concept. We have used it to assess changes required to enable core CSC2 processes (Figure 1). From this analysis, we believe there are several broad areas in which change is required. It is imperative that CS planners become active participants in operations planning processes and that the CS capability is integrated into all planning cycles, from early campaign planning to air tasking orders. In all cases, we should be able to interject timely CS capability information in operationally relevant terms. We also must codify a standing organizational framework to facilitate the process of resource arbitration at various command levels when triggering events identify competing requirements. Further, we need to strengthen our communications processes between supporting and supported functions. Finally, we must further develop closed-loop feedback and control processes to incorporate execution results and forward-looking assessments into the CS decision cycle—often called CS battlespace awareness.

These core CSC2 process changes will serve as guiding principles as we develop transition plans to implement a CSC2 operational architecture.



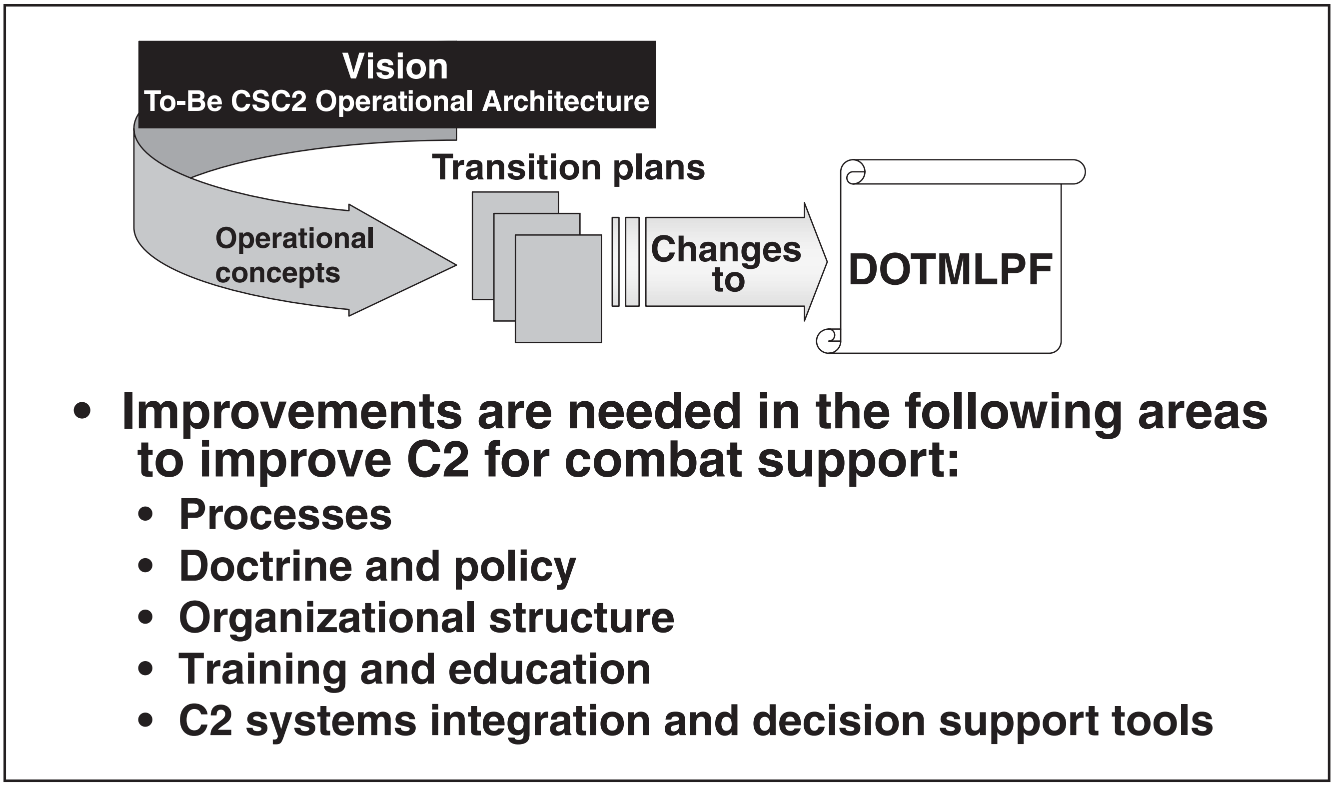


Figure 1: Implementation Process

Doctrine

Part of the implementation plan will be to institutionalize best practices and evolve organizations through doctrine. A couple of examples of best practices are the logistics sustainability analysis process, validated during the preparations for Operation Iraqi Freedom and led by the Air Force Combat Support Center Agile Combat Expeditionary Support Analysis Team, and the centralized intermediate-level repair facility (CIRF) test. These planning, assessment, and execution processes are being written into doctrine to capture and institutionalize lessons learned. We also have initiated a review of current Air Force doctrine and policy and started revisions to reflect the core processes and required organizational framework for CSC2. Changes are already in work with the revision of Air Force Doctrine Document (AFDD) 2-4, *Combat Support*. Further, as AFDD 2, *Organization and Employment of Aerospace Power;* AFDD 2-6, *Air Mobility Operations;* and AFDD 2-8, *Command and Control*, come up for revision, we will be deeply involved in incorporating revised CSC2 concepts into these documents as well. Air Force policy and procedures also will be written or modified in Air Force instructions in tactics, techniques, and procedures format, where appropriate, to further detail the doctrinal concepts.

Organization

The organizational framework is an important part of the implementation plan. We endorse the CSC2 nodal construct found in *An Operational Architecture for Combat Support Execution Planning and Control*, RAND Project Air Force Report MR-1536, 2002. A reader familiar with the report will notice that we have modified some of the names and grouped functions somewhat differently than those outlined in the report. The alignment of C2 responsibilities must be clearly defined and assigned to standard CS nodes.

Specific organizations will be designated to fulfill the responsibilities of each of the nodes. The organizational template allows for variations in organization assignments by theater, while retaining standard *grouped* responsibilities. It may serve as a guide to configure the C2 infrastructure, based on the current requirements. Along with the template, having standing CSC2 nodes that operate in both peacetime and wartime can ease the transition from daily operations to higher intensity operations and allow us to train and work the way we intend to fight.

We have made several decisions on the names for standing CSC2 organizations and the chains of communication between them and identified initial responsibilities and information flows to better facilitate integrated operations. Our TO-BE CSC2 architecture outlines changes in three key organizations: the commander, Air Force forces (COMAFFOR) operations support center (OSC), commodity control points, and Air Force Combat Support Center.

Within the MAJCOMs, operations support centers have evolved as a matter of necessity for handling day-to-day contingency support. Air Combat Command has an operations support center, United States Air Forces in Europe (USAFE) calls its organization the USAFE Theater Air Support Center, and Pacific Air Forces (PACAF) has the PACAF Operations Support Center. These organizations are at various stages of evolution, and we will work with each of the MAJCOMs to institutionalize the roles and responsibilities of combat support within their operations support centers. We have made progress in the spares area by establishing C2 capabilities in the regional supply squadrons. The C2 features of the regional support squadron can be accessed *virtually* by the OSC CS personnel on the A4 staff. As an example of the process of resource arbitration, there is a success story from Noble Anvil with the CIRFs in USAFE. CIRF operations in Operations Iraqi Freedom and Noble Anvil were directed from the regional support squadron, which, during Enduring Freedom and Noble Anvil, was acting as envisioned in the TO-BE architecture as a virtual component of the operations support center. As an illustration, the regional support squadron would

Major General Sullivan

Major General Kevin J. Sullivan is Commander, Ogden Air Logistics Center, Air Force Materiel Command, Hill AFB, Utah. At the time of this study, he was Director of Logistics Readiness, Office of the Air Force Deputy Chief of Staff, Installations and Logistics. The directorate is responsible for organizing, training, and equipping 33,000 people worldwide in the Air Force logistics readiness career field and for ACS concepts and doctrine.

He was commissioned through the Air Force ROTC program following graduation from the University of Connecticut in 1974. He has held various assignments with Tactical Air Command, Strategic Air Command, Pacific Air Forces, US Air Forces in Europe, Air Force Materiel Command, and Headquarters Air Force. His responsibilities covered aircraft and munitions maintenance operations, management, and policies, as well as depot-level maintenance production and major weapon system acquisition activities.

direct the next serviceable asset repaired at the CIRFs to the unit that would best maximize the warfighting capability. CIRF operations will provide further capability as they become a standardized part of the CSC2 nodal construct with automated tools to prioritize repairs and distribute serviceable assets. Work is underway to formalize roles and responsibilities for the CIRFs as a part of the CSC2 organizational framework.

RAND's operational architecture report addresses organizations designed to manage the supply of resource commodities to supported forces. Commodity control points (called virtual inventory control points in the report) exist within different organizations, but their processes remain the same. According to maintenance concepts of operation, spares management is being organized along weapon system lines by a commodity control point at Air Force Materiel Command (AFMC). This function is being aligned with weapon system supply chain managers. Thus, supply chain managers will manage their resources until they cannot resolve competing demands. Then resource arbitration will be elevated to the supported operations support center or further to the Air Force Combat Support Center, if required. In practice, the Combat Support Center, located in the Pentagon, is making arbitration decisions for allocations among competing areas of responsibility and COMAFFORs when demands exceed supply. The Combat Support Center allocates resources in accordance with theater and global priorities. Some of these decisions may be aided by information systems that carry combatant commander priorities and priorities among the various combatant commanders. Some of this logic has been worked into the centralized Execution and Prioritization of Repair Support System algorithms being run at the AFMC commodity control point; that is, the AFMC Supply Management Division. In light of the global nature of air and space expeditionary forces, worldwide commitments, and limited resources, other commodities should be considered for management in the same manner.

Training

As organizations and their C2 responsibilities become institutionalized, they must be staffed with highly effective CSC2 personnel who have been purposefully developed through training, leadership, and education opportunities. This can be done through expanding CSC2 training objectives in operations-focused wargames and exercises. These training objectives should reinforce revised CSC2 doctrine and policy, as well as address recent C2 lessons learned. We will take advantage of joint services logistics wargames (for example, the Focused Logistics Wargame) to evaluate new concepts and expand training in tactical-level venues (for example, Eagle Flag). There will be an education working group, as part of the implementation team, to address the development and enhancement of formal education programs. The Advanced Maintenance and Munitions Officers School at Nellis AFB, Nevada, already has implemented significant C2 instruction in its curriculum. Additional opportunities will exist as we develop the Expeditionary Combat Support Executive Warrior Course and Advanced Logistics Readiness Officer Course and expand the Air Command and Staff College curriculum to include an Agile Combat Support specialized study course. We also can develop job performance aids for CS personnel who routinely step into one-deep positions at a numbered air force, a MAJCOM, or the Air Staff. The curriculum in both the operations and CS disciplines should be updated to address the impact of combat support in operations planning.

Material

The implementation of a responsive CSC2 operational architecture must include a review of the material, in this case information systems, required to support it. The CSC2 implementation effort will be fully integrated with our Future Logistics Enterprise and other CS enterprise architectures. We will develop systems and technical architecture views, as shown in Figure 2, that are Enterprise Architecture Initiative compliant.

Within the systems architecture will reside the CSC2 tools that provide responsive capability analysis and decision support for the resource arbitration process, CS execution feedback (equivalent of battle damage assessment for operators), and forward-looking assessments. These tools should strengthen communication channels between supporting and supported functions. Air Force CS functional communities will work together to integrate CSC2 architectures and the Future Logistics Enterprise to build the foundation for making combat support truly agile.

Leadership and Education

As indicated earlier, the key to actualizing this vision is leadership. The success of CSC2 will rest on the shoulders of those tasked to implement the concepts. Efforts toward implementing the concepts already have begun through the Air Staff-led implementation team. They cannot operate in a vacuum; every one of you touched by these processes has an obligation to help. At the Air Staff, we are well aware there is much to be done, and we appreciate the work RAND and others have done to help us start down this path.

Managing the Way Ahead

As discussed, achieving the required capabilities of the TO-BE CSC2 architecture will require significant changes in DOTMLP. We have chartered a formal change management team in the Air Force Planning, Doctrine, and Wargames Division to oversee and manage these changes. The process we will use is shown in Figure 3. We have designed this process to be open to input and will begin with working groups that have MAJCOM representatives to refine process changes contained in the operational architecture. Specific milestones and actions have been identified for these working groups, and they include validation and

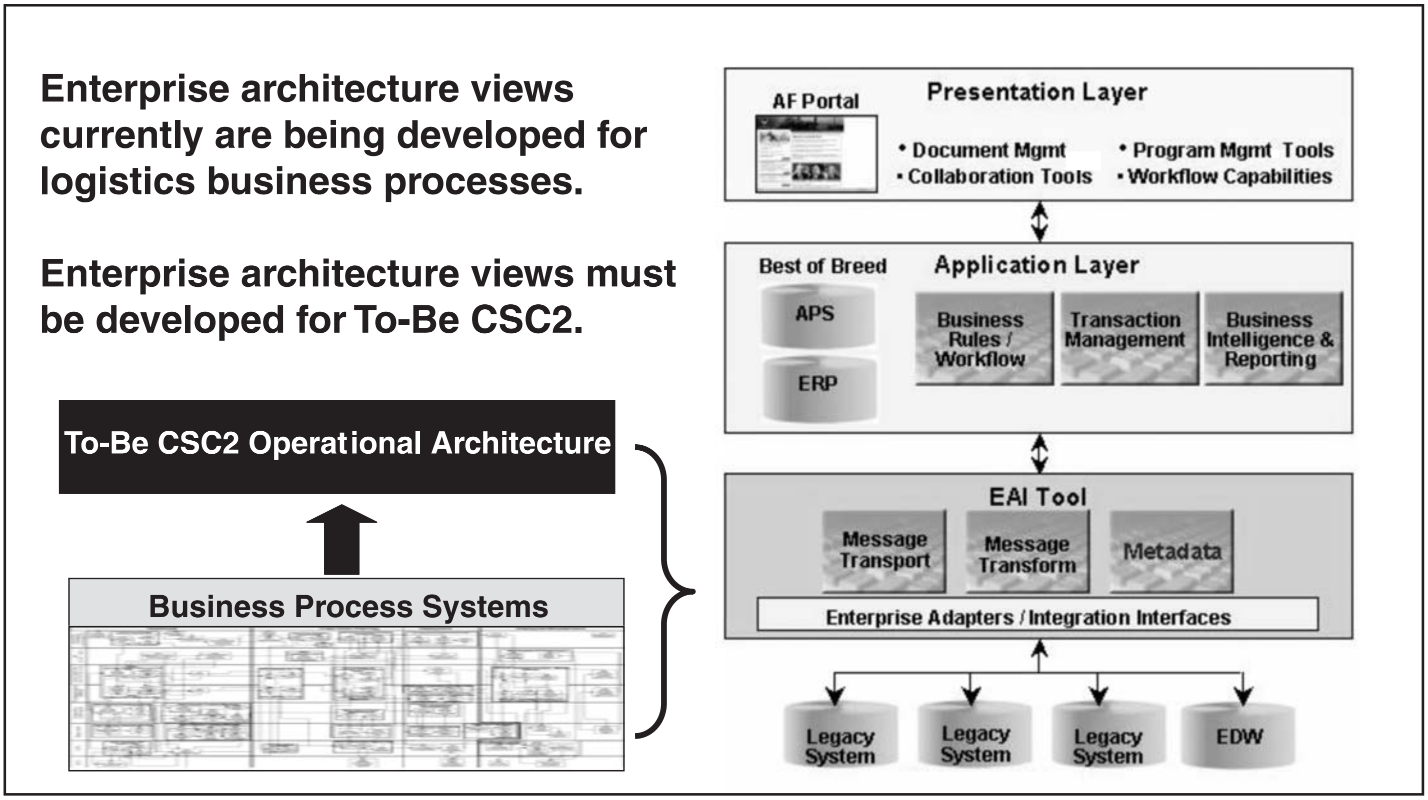


Figure 2. Enterprise Architecture

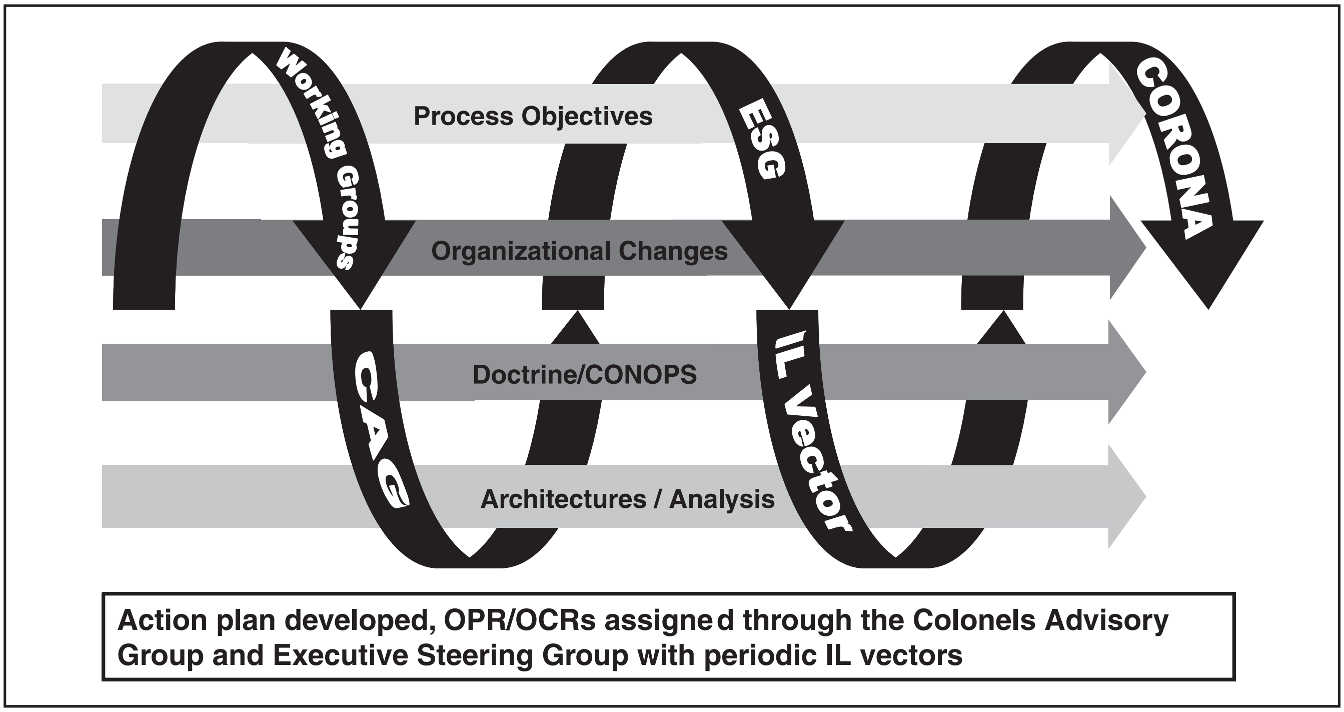


Figure 8. Managing Change

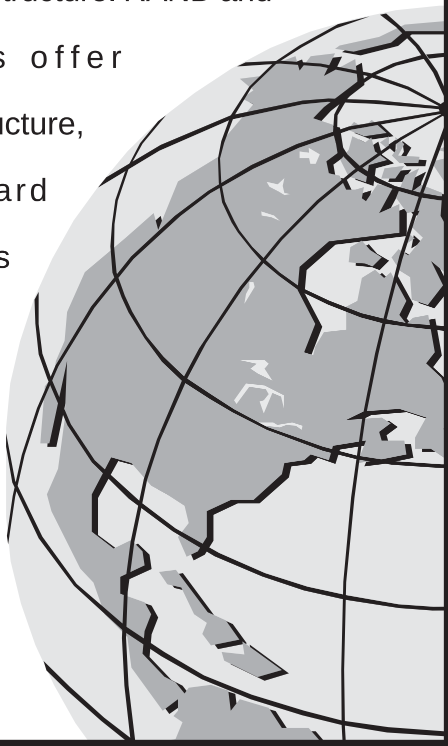
refinement of the TO-BE processes to ensure corporate buy-in of the end states. The end states will be used to establish specific plans for changing processes, organizational changes, doctrine, and system architectures. The ACS Colonels Advisory Group has representatives from across the Air Force and is chaired by the Chief, Planning, Doctrine, and Wargames Division. The Colonels Advisory Group will advise and direct the issue working groups and elevate appropriate decisions to the Executive Steering Group, which is composed of general officers and Senior Executive Service personnel. The Executive Steering Group, chaired by the Director of Logistics Readiness, with broad ACS representation, will review issues and recommendations before they are sent to the Deputy Chief of Staff, Installations and Logistics for approval. As necessary or desired, actions and issues will be sent to the Deputy Chief of Staff, Installations and Logistics for approval to present to Air Force senior leaders at Corona conferences or other forums. CSC2 is increasingly important for creating and sustaining Air Force capabilities. The implementation process will remain a high priority as we continue to build consensus, assign resources, and guide the implementation work groups toward our desired end state. It will take all of us to get there.

C2 Combat Support

Analyzing Command and Control Needs

combat support studies

The shift toward expeditionary operations presents numerous challenges, particularly in combat support . To meet these challenges, the Air Force requires a *global* CS infrastructure. RAND and AFLMA-partnered analyses offer recommendations for such an infrastructure, which include developing forward operating locations from which missions are flown, forward support locations and CONUS support locations, regional repair and storage facilities, a transportation system for distribution, and a combat support command and control system.



Robert S. Tripp, PhD; Patrick Mills; Amanda Geller; C. Robert Roll, Jr, PhD; Major Cauley von Hoffman, USAF; Lieutenant Colonel David L. Johansen, USAF; and James A. Leftwich

Combat Support C2 Architecture

Motivation

Since the end of the Cold War, the US security environment has undergone extensive transitions. Combat has evolved from a theater-centric perspective, which focused on well-understood enemies in well-known locations, to a global perspective that requires preparations for conflicts at any time and in any part of the world. During the Cold War, the United States had a large force presence permanently positioned at established bases, but more recent demands for US military presence or intervention have required the Air Force to stage a large number of deployments, often on short notice and to unanticipated locations, with a substantially smaller force than existed in the 1980s. In response to this changing environment, the Air Force formulated a new concept of force organization, the air and space expeditionary force (AEF). The expeditionary concept is based on the premise that forces tailored rapidly to support anything from a small-scale contingency to a major theater war—deployed quickly from the continental United States (CONUS) to locations around the globe and employed immediately—can serve as a viable alternative to the permanent forward presence established in the Cold War.

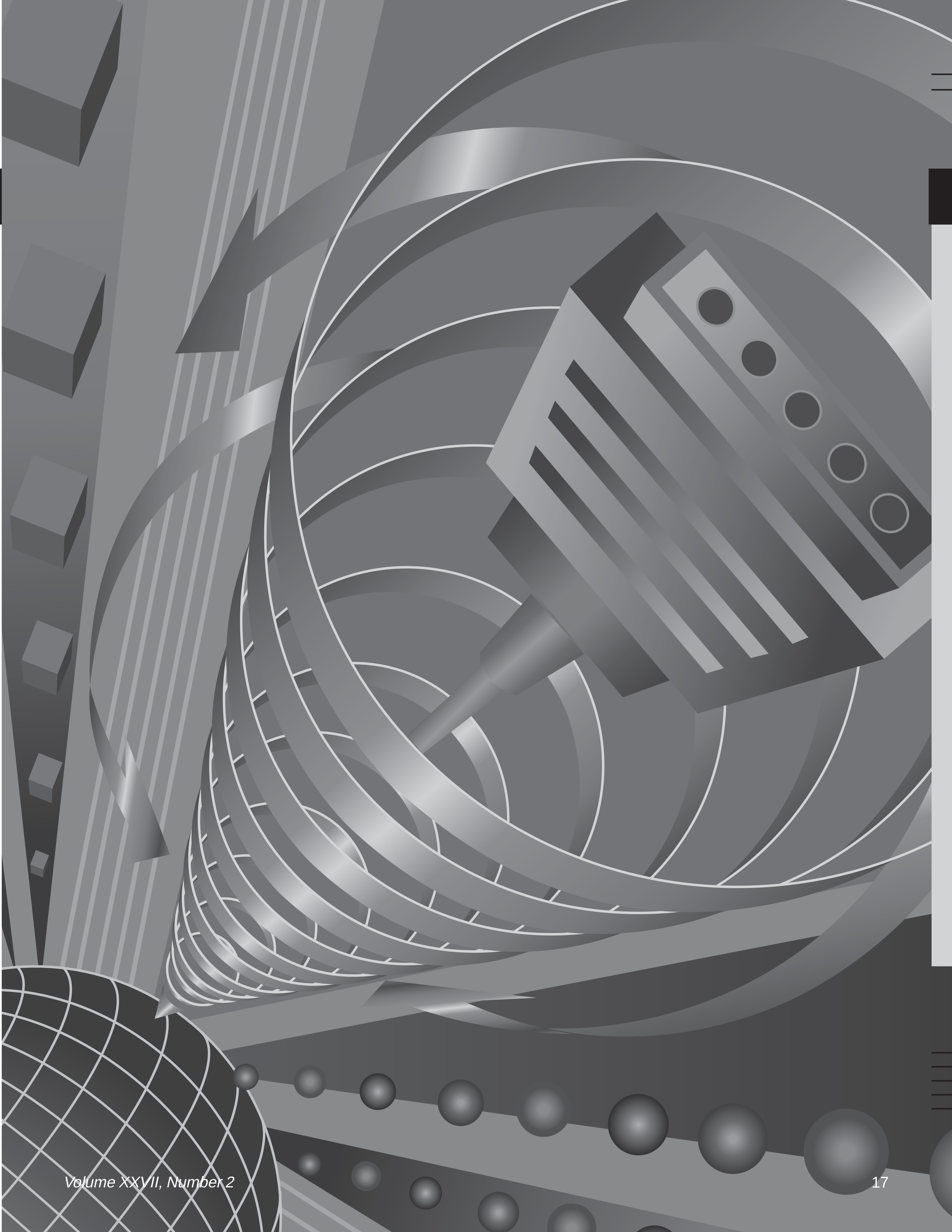
The shift toward expeditionary operations presents numerous challenges, particularly in combat support (CS). To meet these challenges, the Air Force requires a *global* CS infrastructure. RAND and Air Force Logistics Management Agency (AFLMA)-partnered analyses offer recommendations for such an infrastructure, which include developing forward operating locations (FOL) from which missions are flown, forward support locations (FSL) and CONUS support locations (CSL), regional repair and storage facilities, a transportation system for distribution, and a combat support command and control (CSC2) system.

At the request of the Air Force Deputy Chief of Staff, Installations and Logistics (Lieutenant General Michael E. Zettler), RAND Project Air Force (PAF) and AFLMA began an indepth analysis of the CSC2 system in October 2000. This article briefly summarizes their work in this area. In this work, we presented concepts for guiding the development of architecture for CS execution planning and control activities within an integrated operations and CSC2 framework.[1] We use CSC2 as a shortened name but stress that this architecture is part of the integrated operations and CS framework. This architecture is intended for use in transforming the current Air Force CSC2 system into one more capable of supporting expeditionary forces.

Implementing the AEF: Expeditionary Combat Support

Initially, the Air Force gave a great deal of attention to determining AEF composition and scheduling. With respect to deployment responsibilities, much of the effort and progress concerning expeditionary combat support focused on the deployment execution—how to compress time lines for deploying a unit's support functions, given current processes and equipment.

To complement Air Force progress in these areas, we have concentrated on strategic decisions that affect the design of the CS infrastructure necessary to support rapid



deployments. The original AEF concept envisioned packages deploying to any airfield around the world that had a runway capable of handling the operational airlift aircraft, regardless of whether the airfield was a fully equipped base or a bare base with minimal facilities. Reliance on prepositioned assets was to be minimized, if not eliminated. However, analyses have shown[2] that, at present, prepositioned assets cannot be entirely eliminated: the current logistics processes cannot support the timing requirements, and most equipment is too heavy to deploy rapidly. While new technologies and policies can improve this situation in the mid to long term, implementing the AEF concept currently requires judicious prepositioning overseas. Global CS infrastructure preparation is, therefore, a central function of planning expeditionary support. There are five basic components of the global infrastructure: forward operating locations, forward support locations, CONUS support locations, a responsive distribution system, and a CSC2 system.

FOLs are locations from which aircraft conduct their operations or missions. Each FOL requires different amounts of equipment to prepare the base for operations and, as a result, has a different time line and transportation requirement. Two options are available for supplying these resources: FSLs in or near the theater of operations and CONUS support locations. An FSL can be a storage location for US war reserve materiel (WRM), repair location for selected avionics or engine maintenance action, transportation hub, or combination thereof. The exact capability of an FSL will be determined by the forces it will support and by risks and costs of positioning specific capabilities. The network of CSLs, FSLs, and FOLs needs to be coordinated to provide the resources necessary to meet operational goals.

The configuration of these components will depend on several elements, including local infrastructure and force protection, political aspects (for example, access to bases and resources), and how site locations may affect alliances. It is, therefore, important to consider tradeoffs between several competing objectives, such as time line, cost, deployment footprint, risk, flexibility, and sortie generation. Prepositioning everything at bases from which operations will be conducted minimizes the deployment airlift footprint and time line required to begin operations, but it also reduces flexibility, adds political and military risk, and incurs a substantial peacetime cost if several such bases must be prepared. Bringing support from the CONUS, on the other hand, increases flexibility and can reduce risk and peacetime cost for materiel. However, setting up support processes in this situation takes longer, and the deployment footprint is larger. FSLs provide a compromise between prepositioning at FOLs and deploying everything from CONUS. They have little effect on the time line for initial capability, but they do avoid the necessity of having a tanker air bridge for the extra strategic lift from CONUS. Further, the airlift that would have been used to deploy support equipment from the CONUS will be available for deploying additional combat units.

The global infrastructure and its network of operating and support locations are also dependent on an assured distribution system and a CSC2 system to orchestrate every facet of FOL beddown and sustainment. If units must deploy with minimal support and depend on resupply from CSLs and FSLs, they will need to have an assured resupply link whose responsiveness is aligned with the support available at the FOL. The strategic infrastructure envisioned here also will require a more sophisticated CSC2 structure to coordinate support activities across the components of the network and phases of operations.[3] This article and accompanying articles in this edition of the *Air Force Journal of Logistics* focus on the command and control (C2) framework required for effective CS execution planning and execution.

Defining CSC2

To begin, a definition of CSC2 is needed. Joint and Air Force doctrine defines command and control as the exercise of authority and direction, by a properly designated commander over assigned and attached forces in the accomplishment of the mission.[4] Specifically, command and control includes the battlespace management process of planning, directing, coordinating, and controlling forces and operations. It involves integration of the systems, procedures, organizational structures, personnel, equipment, information, and communications designed to enable a commander to exercise command and control across a range of military operations.[5] The definition of an operational architecture encompasses many of the same elements. It is a description of tasks, operational elements, and information flows required to accomplish or support a Department of Defense function or military operation. In our study, we used these definitions, applied to Air Force CS activities, to identify and describe processes involved in CSC2 at each echelon and across the phases of operations.

Developing an Operational Architecture for CSC2

The objective of our analysis was to develop a set of concepts the Air Force can use to establish a CSC2 operational architecture capable of supporting the AEF. The analytic approach used in developing the TO-BE architecture is shown in Figure 1. The first step in this approach was to define expected CSC2 functionality. The objectives of CSC2 are dictated primarily by AEF operational needs summarized in Table 1, along with the CSC2 functionality required to meet them.

Based on the desired CSC2 functional characteristics and analysis of the *AS-IS* architecture, we developed *TO-BE* concepts and an associated operational architecture. The *TO-BE* operational architecture is documented in a database containing process activities and tasks in a hierarchical structure. It also contains information required to perform the tasks and information source; products produced by each activity and recipient of the product; and finally, the identification of the organizational node responsible for performing the activities and tasks.

Our analysis of the Air Force CSC2 process revealed critical *process* shortfalls in the *AS-IS* architecture; these can be grouped into four categories:

- Poor integration of CS input into operational planning
- Absence of feedback loops and the ability to reconfigure the CS infrastructure dynamically
- Poor coordination of CS activities with the joint community
- Absence of resource allocation arbitration across competing theaters

In the report, we propose a *TO-BE* CSC2 system that would enable the Air Force to meet its operational goals by relying on proven process elements. The future architecture would:

- Enable the CS community to estimate requirements quickly for force package options, assess the feasibility of operational and support plans, and establish performance parameters needed to achieve desired operational effects;
- Quickly determine beddown capabilities, facilitate rapid time-phased force and deployment data (TPFDD) development, and configure a distribution network to meet employment time lines and resupply needs;
- Facilitate execution resupply planning and monitor performance;
- Determine impacts of allocating scarce resources to various combatant commanders; and
- Indicate when CS performance deviates from the desired state and facilitate development and implementation of get-well plans.

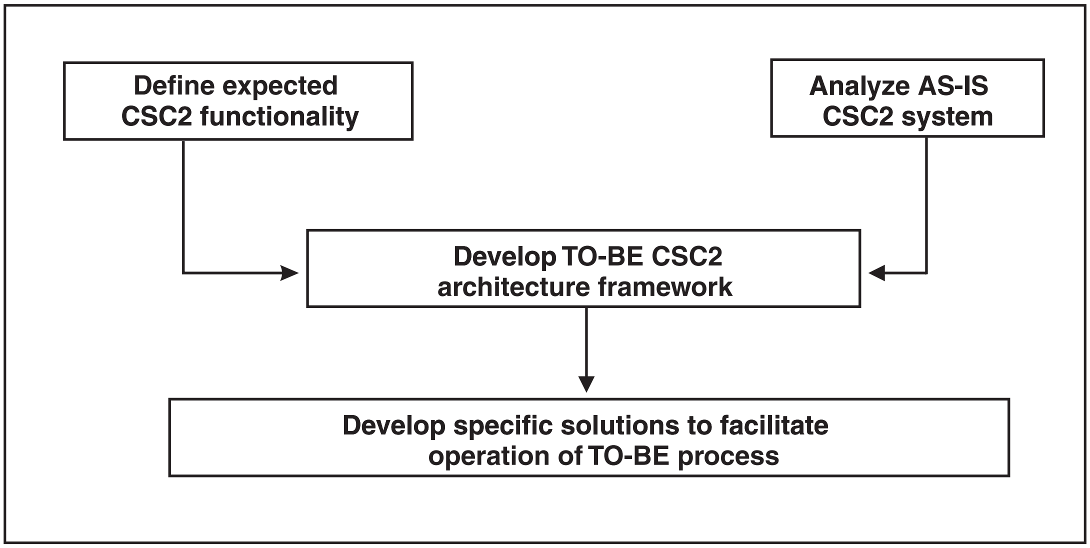


Figure 1. Analysis Approach

EAF Operational Need	CSC2 Requirements
Rapidly tailor force packages to achieve desired operational effects	Estimate CS requirements for suitable force package options; assess feasibility of alternative operational and support plans; create CS performance parameters necessary to achieve operational effects
Deploy rapidly	Determine FOL beddown capabilities for force packages and facilitate rapid TPFDD development
Employ quickly	Configure distribution network rapidly to meet employment time lines and resupply needs
Shift to sustainment smoothly	Execute resupply plans and monitor performance
Allocate scarce resources to where they are needed most	Determine impacts of allocating scarce resources to various combatant commanders and prioritize allocations to users
Adapt to changes quickly	Indicate when actual CS performance deviates from planned performance parameters and initiate and implement get-well plans

Table 1. CSC2 Functionality Required to Meet AEF Operational Goals

Finally, the report offers recommendations to help transition the Air Force CS community from the current CSC2 architecture to the future concept. The recommendations are as follows:

- Clarify Air Force CSC2 doctrine and policy
- Evolve to standing CSC2 organizations
- Emphasize enhanced training for both operations and CS personnel on CSC2
- Enhance capabilities by fielding appropriate CSC2 information systems and decision support tools

The article by Major General Kevin Sullivan on page 6 provides details on implementation actions.[6]

Process Shortfalls

Poor Integration of CS Input into Operational Planning

The conventional roles of the operations and CS communities entail separate and relatively independent activities. Operational plans often are developed without adequate regard to CS feasibility.[7] Figure 2 identifies where some of these disconnects impact the planning and execution process. Early in the planning process, the strategy cell, consisting of A-3 and A-5 planners, is responsible for recommending courses of action to the Joint Forces Air Component Commander. CS personnel are then tasked with supporting the operational plans and must generate the appropriate resources to support a particular TPFDD or air tasking order. This serial approach can result in prolonged development of unsupportable plans, requiring major restructuring when CS factors are eventually brought to light. When attempts are made to incorporate CS input into operational planning, the traditional separation between these communities hinders effective integration. Most logisticians, for example, are not trained in and do not participate in air campaign planning and, therefore, may not have a full understanding of how and when CS considerations are used in the planning process.[8] In many of the CS functional areas, people are not equipped to communicate essential aspects of CS options in operationally understood metrics. As a result, information is not always provided to planners in operationally relevant terms; for example, forward operating location, initial operating capability, and sortie generation capability.[9]

Furthermore, when plans are discovered to be unsupportable, CS personnel are generally not familiar enough with operational objectives to contribute to the development of alternative plans.

At the same time, operators lack CS training and, hence, tend not to consider the effect support capabilities have on the performance of planned missions. Part of planning effects-based operations must include the CS metrics that will enable them; for example, the sortie generation capability by day for each mission design series. When CS aspects of plans are overlooked, the importance of reliable information throughout the operational planning process is not valued. This delays plan development, slows the response to changing plans, and increases vulnerability to failure for want of adequate support.

An additional hindrance to the incorporation of CS input into operational planning is a lack of capability assessments driven by the general shortage of up-to-date and reliable CS resource information. Assessments may be available for some high-priority situations as a part of the deliberate planning process, but they are made for specific circumstances and, hence, are not conducted with a systematic methodology. Therefore, when information and assessments are needed quickly for nonstandard contingencies, the process is slow and ad hoc, with data requirements and organizational responsibilities being ambiguous and inconsistent. In other cases, assessment techniques may exist—for example, readinesss spares package assessment techniques—but information on the projected operations tempo may not be made available to supply analysts. There are no ready sources or a standing organization where this information can be found. One of the most commonly described shortcomings of the crisis action planning process is that operators have to make plans with insufficient and unreliable logistics data.[10] As a result, aspects of plans often are based on outdated information and assumptions with CS information requested piecemeal as it becomes necessary.

Absence of Feedback Loops and the Ability to Reconfigure the CS Infrastructure Dynamically

In the outlined *TO-BE* concept, CS and operations activities must be monitored continuously for changes in performance and regulated to avoid failures. This requires monitoring, assessment, and intervention capabilities more sophisticated than now employed. Currently, asset visibility is limited, and intransit visibility is incomplete.[11] Thus, it is difficult to estimate resource levels and arrival times. Rates of critical processes (component failure, repair, munitions buildup, cargo transportation, and civil engineering) are recorded sporadically. Even when these resource and process data are available, they are typically the focus of planning and deployment activities, but less so for employment and sustainment. Because operations can change suddenly, these data must be continuously available throughout operations in order to make adjustments. Currently, no process or organization exists to support this functionality.

When monitoring reveals a mismatch between desired and actual resource and process performance levels, the ability to assess the source of this discrepancy is often lacking. This is particularly true for activities acting across multiple theaters, such as depot repair, or multiple services, such as a theater distribution system. With limited monitoring and fault assessment, the ability to intervene and adjust CS activities in real time is limited.

Poor Coordination of CS Activities with the Joint/Allied/Coalition Communities

Ultimately, most CS activities entail some degree of coordination among the services and with the joint community. Examples include fuels management, distribution and storage of munitions and housekeeping sets, and transportation. Nowhere is such coordination more important and troublesome than in transportation management. Inter- and intratheater transportation relies on the combined efforts of the regional combatant command and its service components, all of which maintain separate responsibilities and depend on each other for successful operation. Nominally, the Air Force is responsible for providing airlift, the Army is responsible for providing surface lift and port management, and the combatant commander manages theater distribution, through the appointment of one service component as the executive agent.[12]

Although, in principle, the transportation system can operate smoothly when all components are involved, troubles arise when the relative roles of the different contributors in an operation vary substantially. If the Air Force plays a much larger role than the Army, as it did in Operation Noble Anvil, distribution can suffer for lack of clearly defined responsibilities. Despite the mature infrastructure available in Europe, the transportation system during Noble Anvil was slow to start and relied on ad hoc solutions that bypassed standard procedures.[13]

This reflects a disconnect between AEF goals and Air Force efforts to implement them. While the Air Force has gone to great lengths to better tailor force packages and deploy them, it has focused largely on unit-based resources and activities and much less so on the equally important theater-based CS aspects. Effective combat support for the AEF relies on rapid and reliable transportation, and efforts must be implemented to establish theater distribution systems under all circumstances—taking full advantage of cooperation with the Army, joint community, and allied and coalition forces, when available, and having the ability to configure alternative systems in situations where these resources are not available.[14]

Just as CS needs and capabilities must be communicated to operations planners, so, too, must they be communicated with other service, joint, and allied or coalition forces. In considering intratheater movement, the Air Force must be capable of determining transportation requirements based on anticipated sortie production goals and understand in what form those requirements should be communicated to the agency responsible for the theater distribution system.

Similarly, CS personnel should clearly define base capability information needed to conduct beddown assessment and be prepared to provide those requirements to coalition or allied forces that may host Air Force forces in a contingency. Such communications with allied and coalition forces could accelerate the site survey and beddown planning activities during the time-critical crisis action planning process.

Absence of Resource Allocation Arbitration Across Competing Theaters

The current process does not include activities and procedures for formally allocating scarce resources across competing demands. To meet increasing support needs in a theater preparing for or engaged in a contingency, resources reserved for use in other regions often must be diverted. However, the capability to

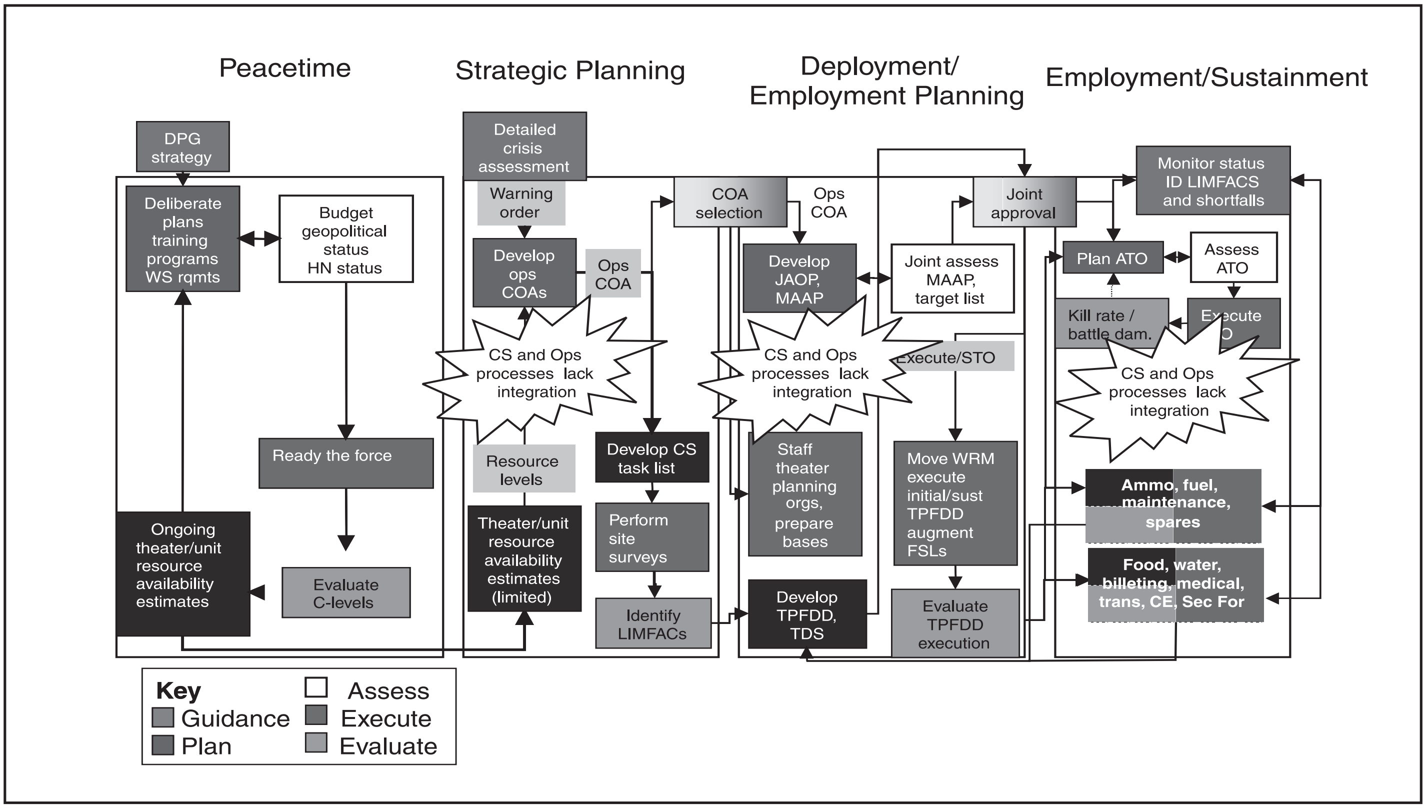


Figure 2. Combat Support and Operations Process Integration Shortfalls

assess quickly the impact to readiness, from a global perspective, of moving resources from one theater to another does not exist. For example, the Ammunition Control Point at Hill AFB, Utah, controls the global prepositioning and movement of munitions. However, there are no processes or automated decision tools in place that can provide an operational impact assessment based on the losing theater's operational requirements outlined in its operations plan.[15] While the Execution and Prioritization of Repair Support System has algorithms that can distribute spares from repair depots to different regions based on maximizing aircraft availability, current contingency operations tempo data may not be updated on a timely basis, which could affect allocation decisions. Joint Chiefs of Staff (JCS) project codes, which determine priority for spares distribution, are established to help move highest priority cargo more quickly. However, most important cargo for the contingency carries these designators, and thus, the priority system reverts to a first-in first-out system. This can be particularly detrimental when high-demand, low-density spares are considered. While the Centralized Intermediate Repair Facility (CIRF) concept[16] has great potential for more effectively managing constrained resources, it is important to note that no formal process or tools exist to prioritize the repair sequence and allocation of these assets from a global perspective. Other commodities lack even a central authority for resource allocation. In this instance, competing resource issues are resolved in an ad hoc fashion that eventually must be settled at the JCS level.

CSC2 Concept for the Future—The *TO-BE* Concept

The High-Level CSC2 Process Template

The *TO-BE* concept integrates operational and CS planning in a closed-loop environment, providing feedback on performance and resources.[17] Figure 3 illustrates the elements of these concepts in a process template, which can be applied through all phases of an operation, from readiness through deployment, employment, and sustainment, as well as redeployment and reconstitution. It centers on integrated operations and CS planning and incorporates activities for continually monitoring performance and dynamically making adjustments.

Some elements of the process, on the left side of Figure 3, are accomplished in planning for operations. The process centers on integrated operations and CS planning and incorporates activities for continually monitoring and adjusting performance. A key element of planning and execution in the process template is the feedback loop that determines how well the system is expected to perform (during planning) by developing and monitoring measures of effectiveness or is performing (during execution) and warns of potential system failure. It is this feedback loop that tells CS planners to act when the CS plan and infrastructure should be reconfigured to meet dynamic operational requirements, during both planning and execution. The CS organizations will need to be flexible and adaptive to make changes in execution in a timely manner.

The feedback loop not only drives changes in the CS plan but also might call for a shift in the operational plan. For the CS system to provide timely fee3dback to the operators, it must be tightly coupled with their planning and execution processes and

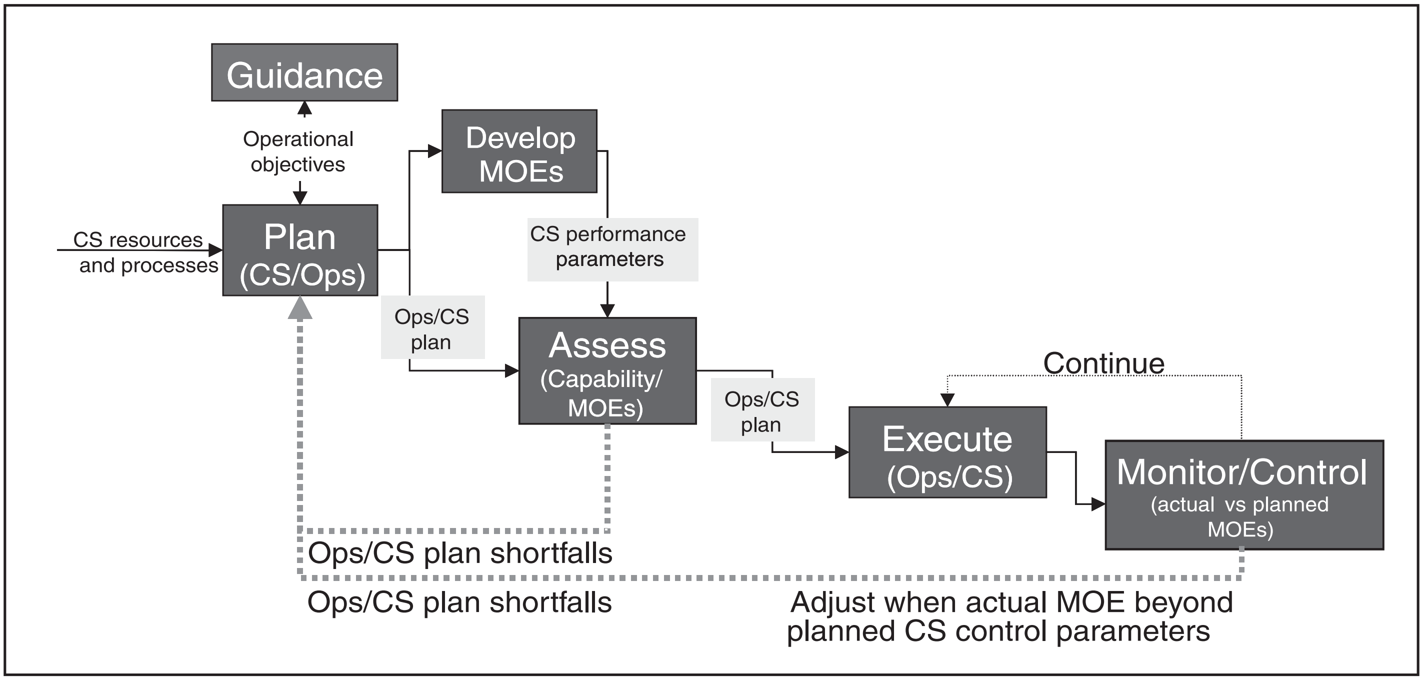


Figure 3. CSC2 *TO-BE* Concept

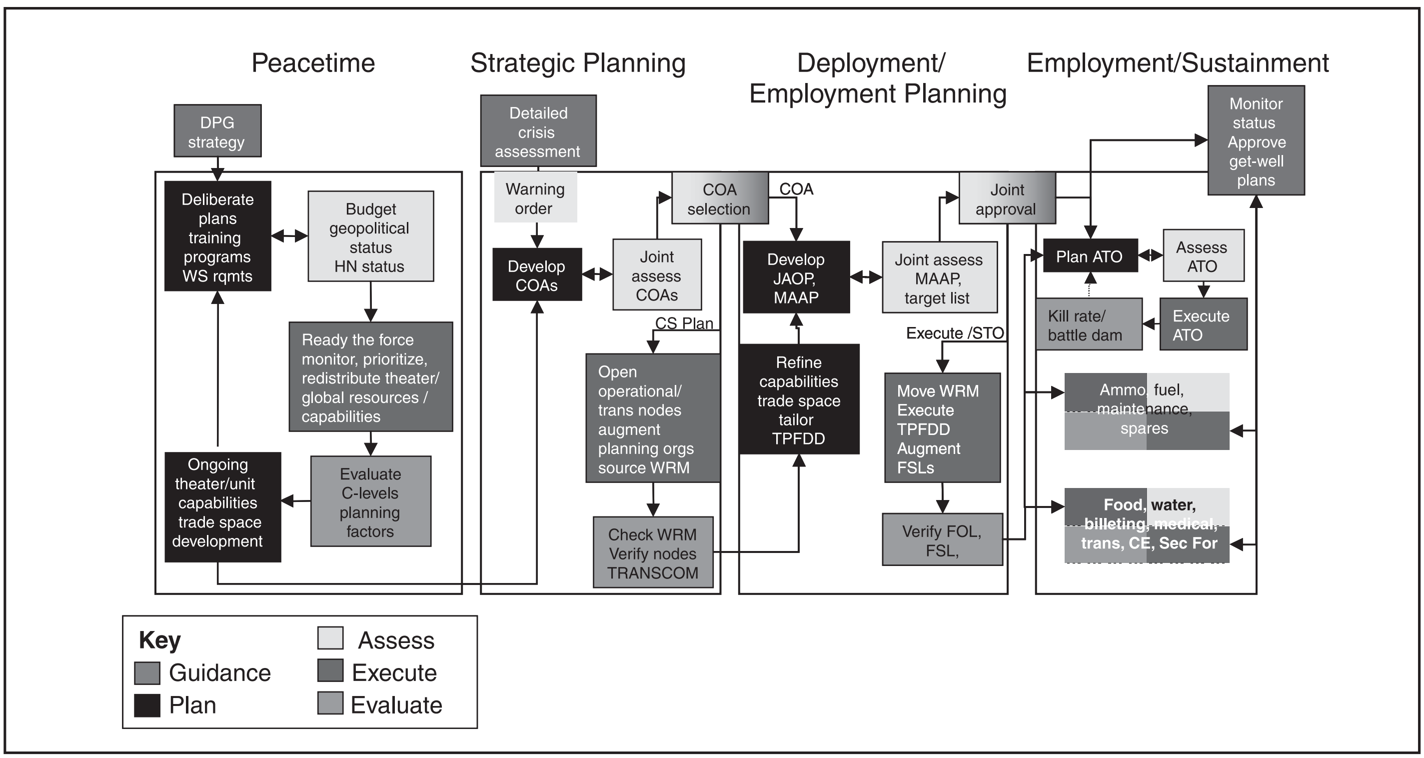


Figure 4. Midlevel Detail of *TO-BE* Process

systems and provide options that will result in the same effects yet cost less in CS terms. Feedback might include notification of missions that cannot be performed because of CS limitations.

Integrating the CSC2 Process Across All Phases of Operational Planning

The planning activities reflected in Figure 3 occur across the spectrum of operations, as illustrated in the mid-level *TO-BE* processes shown in Figure 4.[18] During day-to-day operations, planning supports programmed flying hours to achieve training objectives and prepare for combat. Planning products are flying schedules and air campaign plans for the operators. Similar products for CS personnel would include such products as depot maintenance repair plans, spares allocation plans, and WRM distribution to support the flying program and air campaign plans. On the installation support side, planning products center on infrastructure operation and maintenance, utility operations, and personnel service activities like lodging, dining, and mortuary affairs. During wartime or contingency operations, combat execution is prepared in the crisis action planning process, with similar products and plans produced in a time-compressed environment. For both peacetime and wartime planning, the focus of combat support should be production of installation support and sorties.

From readiness through redeployment and reconstitution, the core process remains the same, but individual information flows vary, and plans and assessments become more refined through each phase. For example, theater and unit capability assessments are performed constantly, beginning in peacetime. The assessment results feed the budgeting and planning processes that allocate funds to programs and redistribute other resources as required for the Air Force to fulfill its Defense Planning Guidance responsibilities. In this example, the assessment results are at a global level and will be used to make strategic resourcing decisions. As a world situation develops, the relationship between CS and operations capabilities feeds into the crisis action planning process and contributes to the development of a suitable course of action. Based on new information (for example, refined operations requirements, known threats, better known theater capabilities), assessments are reaccomplished, the CS plan is refined, and infrastructure configured as necessary to support new courses of action. As a result of the course of action and these CS configuration actions, the relationship of CS capabilities to operations capabilities is again refined to feed into the development of the joint air operations plan; master air attack plan; and eventually, air tasking order. The assessment capabilities and feedback loop enable the iterative planning with operations. This process continues into employment and sustainment and can be observed for the other blocks in the planning and execution process.

Recommendations to Meet the Future State

The *TO-BE* concept presents CSC2 process elements designed around the needs of the AEF: operationally relevant, rapid, and responsive. To improve the existing process performance and achieve process changes necessary to implement the *TO-BE* CSC2 concept, fundamental modifications to several *enabling mechanisms*—including doctrine and policy, organizational responsibilities, information systems, and training and education—must be made. Some of the specific implementation actions are outlined in "CSC2 Architecture: Supporting Expeditionary Airpower," on page 14 of this issue of the *Air Force Journal of Logistics*.

Notes

1. James A. Leftwich; Amanda Geller; David Johansen; Tom LaTourrette; Patrick Mills; C. Robert Roll, Jr;, Robert Tripp; and Cauley von Hoffman, *Supporting Expeditionary Aerospace Fores: An Operational Architecture for Combat Support Execution Planning and Control*, RAND MR-1536-AF, 2002.
2. Research at RAND has focused on defining the vision and evaluating options for an ACS system that can meet AEF operational goals. See Galway, et al, *Supporting Expeditionary Aerospace Forces: New Agile Combat Support Postures*, RAND MR-1075-AF, 2000. Additional research has identified the importance of CSC2 within the AEF ACS system. See Tripp, et al, *Supporting Expeditionary Aerospace Forces: An Integrated Strategic Agile Combat Support Planning Framework*, RAND MR-1056-AF, 1999.
3. The phases of operations include peacetime operations and readiness preparation, deployment, employment and sustainment, redeployment, and reconstitution.
4. Joint Pub 1-02, *DoD Dictionary of Military and Associated Terms*, 12 Apr 01.
5. Air Force Doctrine Document 1, *Air Force Basic Doctrine*, 1 Sep 97.
6. Maj Gen Kevin Sullivan, AF/ILG, "Implementing CSC2," *Air Force Journal of Logistics*, Vol XXVII, No 2, 6.
7. Col Ed Groeninger, PACAF 502/CC, 8 Mar 01.
8. Lt Col Stephen Luxion, HQ CENTAF A3/A5, 9 Feb 01; Van Hazel, Seventh Air Force operations analyst, 10 Dec 01; Maj Parker Northrup, Seventh Air Force Air Operations Group, 10 Dec 01; Maj Steen, PACAF/XPXX, 17 Dec 01; Lt Col Levault, Thirteenth Air Force A3/5, 13 Dec 01.
9. Luxion, et al. In some CS areas, such as those dealing with supply of spare parts, the community has been able to express how a lack of spares impacts weapon system availability or engine and pod availability. This community also can assess how spares availability may impact projected weapon system availability.
10. Luxion, et al, and Joint Expeditionary Forces Experiment 99 and 00 final reports.
11. Regional supply squadrons (RSS) have visibility of spares, with the exception of bench stock, of all units deployed to their area of responsibility (AOR). There are seams, however, in this visibility. As an example, consider a bomber island, Diego Garcia, located in the PACAF AOR but supporting CENTAF operations. The PACAF RSS had visibility of tankers deployed to Diego Garcia but not bombers deployed from ACC. Thus, two reachback systems were used. Furthermore, the status and condition of support equipment held as war reserve materiel at an FOL is not as well known.
12. Joint doctrine specifies that the component with the preponderance of force may be delegated the responsibility for developing and managing the theater distribution system (TDS). In Enduring Freedom, the Air Force was formally delegated TDS responsibility. It long has been the assumption that the Army would have responsibility for TDS, but joint doctrine allows the combatant commander to delegate this responsibility as outlined above. There are current efforts underway to allow the Defense Logistics Agency to assume executive agent responsibility for establishing end-to-end distribution responsibilities for medical, construction, fuels, and subsistence commodities. Other options would call for USTRANSCOM to assume end-to-end distribution responsibilities. This is an area that requires a great deal of attention because of the Air Force's reliance on rapid resupply.
13. Feinberg, et al, *Supporting Expeditionary Aerospace Forces: Lessons from the Air War Over Serbia*, RAND MR-1263-AF, 2002.
14. USAFE has created a theater distribution management center in cooperation with EUCOM to expedite shipments to end users through USAFE APODs.
15. Lt Col Carl Puntureri, JCS/J4 Munitions and NBC Defense Equipment, 23 Feb 01.
16. Robert S. Tripp, et al, *Supporting Expeditionary Aerospace Forces: An Integrated Strategic Agile Combat Support Planning Framework*, RAND, MR-1056-AF, 1999.
17. Elements of these concepts were described in the Air Force C2 CONOPs, Vol III, and the AFMC C2 CONOPS, as well as Pyles and Tripp, *Measuring and Managing Readiness: The Concept and Design of the Combat Support Capability Management System*, RAND, N-1840-AF, 1982.
18. More details can be found in Leftwich, et al.

Dr Tripp is a senior analyst at RAND. Mr Mills, Ms Geller and Mr Leftwich are RAND adjunct staff. Dr Roll is Director, Resource Management Program, Project Air Force. At the time of this study Major Von Hoffman was Deputy Chief, Maintenance and Munitions Division, Air Force Logistics Management Agency. Colonel Johansen is Chief, Agile Combat Support Concept, Doctrine, and Wargames Branch, Directorate of Logistics Readiness, Air Force Installations and Logistics.

Robert S. Tripp, PhD; C. Robert Roll, Jr, PhD; Major Cauley von Hoffman, USAF

Combat Support C2 Nodes

We have presented a *TO-BE* combat support command and control (CSC2) operational architecture[1] that would help the Air Force meet its air and space expeditionary force (AEF) operational goals. The future architecture would:

- Enable the combat support (CS) community to quickly estimate requirements for force package options needed to achieve desired operational effects and assess the feasibility of operational and support plans;
- Quickly determine beddown capabilities, facilitate rapid time-phased force deployment data (TPFDD) development, and configure a distribution network to meet employment time lines and resupply needs;
- Facilitate execution resupply planning and performance monitoring;
- Determine impacts of allocating scarce resources to various combatant commanders; and
- Indicate when CS performance deviates from the desired state and implement replanning and get-well planning analysis.

To help the Air Force CS community transition from the current CSC2 operational architecture to the future concept, we identified several actions that should be taken. Because these changes are significant and will require time to implement, the Air Force will use the joint doctrine, organization, training and education, materiel, leadership, and personnel (DOTMLP) process to evaluate and incrementally implement required changes. Furthermore, the Air Force has created a change agent at the Air Staff, in the Logistics Readiness Directorate, to oversee these changes. This change agent will work with the Agile Combat Support (ACS) Colonels Advisory Group to develop and coordinate changes across all CS functional areas.[2] Some of the major changes include the following:

- Summarizing and clarifying Air Force doctrine and policy. The objectives and functions of CSC2 must be recognized and codified in doctrine. The functions of concurrent development of plans among operators and CS personnel, assessment of plan feasibility, use of feedback loops to monitor CS performance against plans, and development of get-well planning need to be articulated and understood.
- Creating standing CSC2 organizations. The Air Force has been supporting one contingency after another for the last decade. The area of responsibility (AOR) shifts from time to time, as does the operations tempo in various areas of responsibility, but there has been continuous deployment and employment of AEF packages during the last 12 years. Standing organizations are needed to conduct CSC2 functions and reduce turbulence and transition issues associated with transitioning from supporting one contingency to reshaping support processes to meet the needs of future contingencies.
- Training both operations and CS personnel on each other's roles. Understanding each other's responsibilities

and methods can facilitate incorporation of both aspects into operational plans.

- Fielding appropriate information systems and decision support tools. Improved information and decision support tools are needed to translate CS resource levels and process performances into operational capabilities or effects to improve operational understanding of CS constraints or enabling characteristics for any given operational planning option.

In this article, we primarily address the second area in the actions needed above, creating standing CSC2 organizations. Again, we emphasize that organizational development activities are only one of the DOTMLP areas that need to be addressed to achieve comprehensive improvements in linking ACS capabilities to operational effects through CSC2.

CSC2 Nodes and Responsibilities

In the TO-BE architecture, we establish a CSC2 nodal template with clearly defined responsibilities for each CSC2 node. Table 1 shows some of the important CSC2 nodes and their associated roles and responsibilities.

This nodal template is a key element of the *TO-BE* CSC2 operational architecture. The template can ease the transition to a wartime structure. Specific organizations can be designated to fulfill the responsibilities of each node. The template allows for variations in organization assignments by theater and may even serve as a guide for configuring the C2 infrastructure, while retaining standard responsibilities. Along with the template, having standing CSC2 nodes that operate in both peacetime and wartime also can ease the transition from daily to higher intensity operations and allow the Air Force to train the way it intends to fight.

The need for standing CSC2 organizations is driven by the AEF environment. In responding to threats globally, AEF CS resources may need to be allocated from one theater to another to make the best use of available resources. Currently, some resources are primarily confined to individual theaters and are managed by theater-based organizations. These include theater-based munitions and war reserve materiel, intratheater distribution resources, and physical and operational infrastructures. For a large number of resources, this arrangement still may prove effective, but the ability to relocate and allocate these resources to other areas of responsibility needs to be streamlined. Other CS resources currently are managed by units; however, with the advent of the centralized intermediate repair facility and to deal with allocating scarce resources, there may be a need to manage these resources more centrally and from a global perspective. Examples of scarce resources that may need to be managed centrally include spare parts, fuel, munitions, aerospace ground equipment, fuels mission support equipment, and consumables, as well as maintenance and intertheater distribution resources.

Regardless of how CS resources are managed, CS resource assessments and allocation management tasks and responsibilities should be assigned to permanent organizational nodes dedicated to resource monitoring, prioritization, and reconfiguration. Additionally, having a standing integration function for all CS resource management will facilitate the incorporation of relevant resource data into capability assessments and raise the visibility and importance of these assessments in the eyes of the operational community.

In the past, organizational structures were established and responsibilities assigned at the start of a conflict. Responding to continual threats globally places new demands on CSC2. First, the rate of continuing operations is such that organizations seldom desist after supporting a contingency operation; instead, they transfer focus from one conflict to another. Second, CS resources are consumed continually and reconstituted from one contingency only to be used immediately by the next. Many times, demands outpace supply, driving reallocation of resources from one theater to another in order to meet the most urgent demand. As discussed, the ability to relocate and allocate these resources across and among areas of responsibility needs to be streamlined, and an arbitration function must be accomplished. To accomplish an arbitration function, CS resource assessments and allocation management tasks need to be assigned to permanent organizational nodes dedicated to resource monitoring, prioritization, and reconfiguration. An integration function for all CS resource management will facilitate the incorporation of relevant resource data into capability assessments and raise the visibility and importance of these assessments in the eyes of the operational community.

In the remainder of this article, we address three *new* standing organizations and their roles in the TO-BE CSC2 operational architecture: the operations suppo3 CS center.

The Operations Support Center

Integral to implementation of the CSC2 operational architecture is the evolution of operations support centers. Operations support centers will provide air component commanders theater-wide, daily, situational awareness and command and control of air and space, intelligence, surveillance, and reconnaissance, information operations, mobility, combat, and support forces. The operations support center will have the capability to direct deliberate planning and crisis response actions to deploy and sustain forces across the spectrum of operations. Within the operations support center, the A-4 division will act as a regional hub for monitoring, prioritizing, and allocating theater-level CS resources and be responsible for mission support, base infrastructure support, and establishing movement requirements within the theater. The OSC A-4 will be the theater integrator for commodities managed by commodity control points discussed below. To be effective, it must have complete visibility of theater resources and authority to reconfigure these resources. It should have the capability to receive commodity-specific information from commodity inventory managers and perform integrated capability assessments, both sortie production and base, and report those capabilities to the CS personnel supporting air campaign plan, master air attack plan(MAAP), and air tasking order (ATO) production in the air operations center. In this role, it will make resource allocation decisions when there are competing demands for resources within the theater. In the spares area, the Air Force has made progress in establishing some of these capabilities in the regional supply squadrons. The C2 features of the regional supply squadrons can be accessed *virtually* by the Commander, Air Force Forces (COMAFFOR) A4 within the operations support center. Similarly, in the ammunition area, the theater ammunition control points can provide virtual assessment capabilities to the COMAFFOR A4. As prescribed in Air Force Doctrine Document (AFDD) 2-8, the OSC A-4 could perform these reachback functions.[3] It could be devoted to incorporating mission, base infrastructure, and movement capability assessments into operational plans and

CSC2 Nodes	Roles/Responsibility
Joint Staff	
Logistics Readiness Center	Supply/demand arbitration across combatant commanders
Combatant Commander	
Combatant Commander Logistics Readiness Center	Combatant commander logistics guidance and course of action analysis
Joint Movement Center	Combatant commander transportation supply/demand arbitration
Joint Petroleum Office	Combatant commander POL supply/demand arbitration
Joint Facilities Utilization Board	Combatant commander facilities/real estate supply/demand arbitration
Joint Materiel Priorities and Allocation Board	Combatant commander materiel supply/demand arbitration
JTF	
JTF J-4 and Logistics Readiness Center	JTF logistics guidance Supply/demand arbitration within JTF among service components
JFACC	
Joint Air Operations Center CS reps	JAOP/MAAP/ATO production support
JFACC Staff Logisticians	JFACC logistics guidance
Air Force	
Air Force Combat Support Center [1]	Monitor operations—execute C2 Represent Air Force CS interest to Joint Staff Conduct/review integrated weapon system and base operating support assessments Arbitrate critical resource supply/demand shortages across AFFORs
AFFOR	
Air operations center CS element	JAOP/MAAP/ATO production support
AFFOR A-4 Staff (forward)	Site surveys/beddown planning Liaison with AOC CS element
AFFOR A-4 staff (rearward) at an operations support center [2] that supports AFFOR A-4 staff forward	Mission/sortie capability assessments Beddown/infrastructure assessment AETF force structure support requirements Supply/demand arbitration within AETF among AEFs/bases Theater distribution requirements planning Force closure analysis Liaison with Air Mobility Division in AOC Liaison with theater TRANSCOM node
Deployed Units	
Wing operations center	Disseminate unit tasking Report unit status
Combat Support Center	Monitor and report performance and inventory status
Supporting Commands (Force and Sustainment Providers)	
Logistics Readiness Center/Combat Support Center	Monitor unit deployments Allocate resources to resolve deploying unit shortfalls
Deploying Units	
Wing operations center	Report unit status Disseminate unit tasking
Deployment control center	Plan and execute wing deployment Report status of deployment
Commodity Control Points [3]	
Munitions, spares, POL, bare base equipment, rations, medical materiel, etc	Monitor resource levels Perform depot/contractor capability assessments Work with the GIC to allocate resources in accordance with theater and global priorities
Sources of Supply (Depots, Commercial Suppliers, etc)	
Command centers	Monitor production performance and report capacity

1. Some of the functions performed by the Combat Support Center were associated with an organization referred to as the Global Integration Center (GIC) in MR-1536-AF. The Air Force will not use the GIC name in implementation efforts but rather associate GIC functions with the Combat Support Center.
2. The functions performed by the AFFOR A-4 need to be standardized. What a given AFFOR A-4 chooses to do forward and rear can be different for a given theater or region, depending on circumstances. The idea is to codify the responsibilities by COMAFFOR in each region before contingencies begin. Operational Support Center A4 could have virtual RSS representation at the operations support center. Many of the spares-related C2 functions could be conducted at the RSS with Operational Support Center A4 input and coordination. The same is true for ammunition control points.
3. The commodity control point was referred to as a virtual inventory control point in the MR-1536-AF and in several transformation articles associated with the Spares Campaign and Depot Reengineering and Transformation. The Air Force had decided to replace the virtual inventory control point with commodity control point.

Table 1. *TO-BE* CSC2 Nodes and Responsibilities

support the deployed AFFOR A-4 staff during a contingency, minimizing the number of personnel required to deploy forward. It would also alleviate problems associated with an undermanned numbered air force staff currently trying to perform the functions listed above, as well as their roles under the unified command structure. One example of an operations support center has already been established in the United States Air Forces in Europe (USAFE), the USAFE Theater Air Support Center. Another one has been established in the Pacific Air Forces (PACAF), the PACAF Operations Support Center.

Operations support centers would have all A-staff positions, including A-1, 2, 3, 4, 5, 6, and 7 if civil engineering is split out from the A-4. This organization could concentrate on day-to-day execution activities within a major command (MAJCOM) area of responsibility, when not engaged in contingency operations. The MAJCOM staff could concentrate on organizing, training, and equipping headquarters functions. The operations support center could be led by an air operations group (AOG) or squadron commander with the A-3/5 assuming the AOG responsibilities. If the peacetime workload is too small to keep the operation support center active, codification and training become even more important.

Commodity Control Point and Combat Support Center

Commodity control points should be responsible for the management of supplying needed resources to the MAJCOMs and deployed forces. This is essential for management and distribution of critical resources. For example, spares management should be accomplished, along weapon system lines, by a commodity control point at Air Force Materiel Command (AFMC). This standing C2 node at AFMC would operate spares management along the continuum of operations, having immediate access to both the data and analytical tools needed to exercise capability assessments and manage distribution of resources to MAJCOMs and theaters. The commodity control points will take guidance from the operations support centers and, when required, take direction from the Air Force Combat Support Center—a neutral integrator for arbitrating resource allocations among competing areas of responsibility and COMAFFORs. The spares commodity control point would be responsible for monitoring resource inventory levels, locations, and movement information and, using these data to assess contractor and depot capabilities, meet throughput requirements. The Combat Support Center, located at the Pentagon, would use weapon system operational capability assessments and coordinate with the joint community and theater operations support centers to prioritize and allocate resources in accordance with theater and global priorities. These integrated assessments will support allocation decisions when multiple theaters are competing for the same resources and can serve as the Air Force voice to the Joint Staff when arbitration across services is required. In light of the global nature of AEFs and worldwide commitments, other commodities should be considered for management in the same manner.

At both the operations support centers and the Combat Support Center, individual resource prioritization will be guided by a common set of rules: given a required operational capability, the operations support centers will manage the CS resources to meet their area of responsibility needs. When there are multiple ways to achieve the same goals, this will be considered in resource prioritization. Resources then will be assessed and allocated to meet the operational capability requirements set at higher levels (for example, the Joint Chiefs of Staff and Combat Support Center). These resources thus will be allocated according to the need for an overall level of operational capability, rather than on an individual commodity basis.

Based on these assessments and allocations, the commodity control points (within authorized parameters) will direct purchases, repair operations, and distribution of components and spares and will assess the capability to meet combatant commanders' requirements. Theater operations support centers will advise of infrastructure capabilities, needed resources to implement plans, and the consequences of not improving capabilities. Then the theater joint command can prioritize needs and advise the joint staff and others of theater capabilities and issues. Ongoing capability assessments generated by the Combat Support Center and operations support centers will be incorporated into a theater's operational planning processes executed by CS liaisons in the air operations center.

Although these responsibilities can be performed by different organizations in different theaters, the grouping of the tasks, information required to complete them, and products resulting from each task should not change from one theater to the next. Predefining the organizations to perform each task will ensure ownership of tasks; clear lines of communication; and thus, a smoother transition as the level of operations expands and contracts.

In the Air Force implementation plan, the Air Force has begun to expand guiding principles describing the C2 of combat support and is placing these principles in its doctrine. The Air Force has initiated a review of current processes and started revisions to integrate CS planning with operations planning, consequently, enhancing contingency planning. These revisions and enhancements to doctrine and processes will facilitate the allocation of resources according to required capabilities and ensure closed-loop planning and execution functions are created, which will enable better informed plans.

Centralized Planning with Decentralized Execution within Approved Thresholds

It should be emphasized that these CSC2 organizations should operate within the time-tested rules of centralized planning and decentralized execution that long has been associated with planning and executing air and space operations. Table 2 provides an example, using ammunition, of how CSC2 triggers would elevate decisions to the appropriate decision authority once *planned resource levels* have been breached. The table shows the CSC2 decision level, decision authority for that level, decision elevation trigger or tripwire that would cause a decision to be elevated, and decision authority that would be notified if a breach of decision authority should occur. As shown in the top row of the table, the ammunition control point within a theater, a component (virtual most likely) of the COMAFFOR A-4 staff in the operations support center, has the authority to distribute munitions to COMAFFORs within its area of responsibility up to the level that has been established in the AOR support plan and been approved in the program objective memorandum process. When demands from one COMAFFOR exceeds the plan for that COMAFFOR but is within the allocation amount for the area of responsibility, the ammunition initial control point in the area of responsibility needs to elevate the request to the operations support center. The operations support center can reallocate resources within the area of responsibility to satisfy the COMAFFOR that needed the resource. The operations support center would notify the Combat Support Center that this was about to take place. If the area of responsibility needed more resources than it had, the operations support center, as directed by the designated commander, would elevate the request to the Combat Support Center for decision. This may mean that the Combat Support Center, if directed by Air Force Deputy Chief of Staff, Installations and Logistics, as the designated representative of the Chief of Staff of the Air Force for CS resources, may request additional funding to support the requirement. On the other hand, the Deputy Chief of Staff, Installations and Logistics may direct reallocation of resources from other areas of responsibility to meet the needs of this area of responsibility. These decisions would be supported by financial and weapon system support assessments.

By using this set of decision elevation triggers, daily execution activities can be carried out by the lowest organizational level closest to the operation without undue centralized interference. The rules also provide clear lines of responsibilities and signal when higher authority needs to be involved.

Advantages of the New Standing CSC2 Organizations and Rule Sets

This organizational structure offers three important strengths. First, it enables prioritization and allocation based on operational capability assessments. Capabilities are, therefore, estimated in the context of theater and global priorities, and resources are allocated accordingly. This enables a more informed distribution of CS capabilities, allows the movement of resources before requests are made, and reduces the distress of filling emergency requests. The second strength is that this structure considers the complete spectrum of CS resources. Each resource influences operational capability in some way and, hence, must be prioritized and allocated in conjunction with the others. By centralizing CS capability assessments, capability becomes a commodity, which can be managed like any other, with a single set of decisionmakers. While this management is ultimately broken down into the movement of individual resources, these resources are not managed individually but rather in an integrated manner. The third strength is that by establishing nodes to perform designated tasks this structure is a consistent framework for decisionmaking throughout all phases of operations. Because the standing nodes are devoted to the monitoring, prioritization, and reconfiguration of all CS resources, they are equally capable of addressing long-term weapon-system development considerations, peacetime training, or crisis action planning and execution.

Although these responsibilities can be performed by different organizations in different theaters, the grouping of the tasks, information required to complete them, and products resulting from each task should not change from one theater to the next.

Predefining organizations to perform each task will enable a much smoother transition to war. It will provide a better defined communication network and better define the roles that each augmenter needs to train for. This will result in improved training programs and better trained personnel in wartime positions.

Summary

Transitioning from the *AS-IS* to the *TO-BE* CSC2 system requires changes to current doctrine and policy. Both doctrine and policy should emphasize the importance of the CSC2 role; describe the basic objectives, functions, and activities of a CSC2 system; and define organizations to perform these functions and activities.

Once doctrine and policy describing the role of CSC2 is in place, current processes can be revised to integrate combat support and operations planning as well as combatant commander and joint planning, allocate resources according to required capabilities, and create a closed loop between planning and execution functions, which will enable better informed plans as a campaign continues.

Standing CSC2 organizations, with clear chains of communication between them and well-defined responsibilities, could better facilitate CS planning and execution processes. All changes to the *AS-IS* CSC2 system should be reinforced with training and exercises. Developing a CSC2 course curriculum and expanding the role of combat support in wargames and exercises will train the Air Force in the importance of combat support during a contingency. The changes described above also require different information flows and development of decision support tools, implemented on a robust information systems infrastructure. These tools should focus on execution planning and tradeoff analysis and perform functions such as the translation between operational and support metrics, global and theater capability assessments, and the efficiency with which CS processes are performed.

The AEF concept presents significant challenges to the current CS structure. To meet AEF stated objectives, the ACS community has undertaken the challenge of completely reexamining its current support system. Correcting deficiencies in the CSC2 architecture highlighted in this article and further developed in the full report is integral to the success of this effort.

(Continued on page 46)

Decision Level	Decision Authority	Decision Elevation Trigger	Elevation Level
Ammo commodity control point	Allocate munitions to an AFFOR in accordance with established priorities to meet planned requirements	Threshold breach driven by demand from multiple AFFORs within single theater	Operations support center
Operations support center	Munitions allocations within single theater	Threshold breach driven by demand from multiple AFFORs from different theaters	Combat Support Center in consultation and coordination with Operations
Combat Support Center	Munitions allocations to AFFORs in different theaters	Resource competition resulting in capability degradation of one theater versus another theater	Joint Chiefs of Staff and Secretary of Defense

Table 2. CSC2 Nodal Authority and Decision Elevation Triggers

Amanda Geller; Robert S. Tripp, PhD; Mahyer A. Amouzegar, PhD; and John G. Drew

C2 in the CIRF Test: A Proof of Concept

We have, in our reports,[1] described the elements of a global Agile Combat Support (ACS) network capable of enabling air and space expeditionary forces. The components of this global ACS network include:

- Forward operating locations (FOL) that can have differing levels of combat support (CS) resources to support a variety of employment time lines
- Forward support locations (FSL) and continental United States (CONUS) support locations (CSL); that is, sites for storing heavy CS resources such as munitions or sites with back-shop maintenance capabilities such as jet engine intermediate maintenance (JEIM)
- A robust transportation system to connect the FOLs, FSLs, and CSLs
- A combat support command and control (CSC2) system that facilitates estimating support requirements, configuring the specific nodes of the system selected to support a given contingency, executing support activities, and measuring actual CS performance against planned performance, developing recourse plans when the system is not within control limits, and reacting swiftly to rapidly changing circumstances

A notional illustration of these components of the ACS network of the future is shown in Figure 1.

This article focuses on three components of the ACS network: the CSC2 system, maintenance FSLs, and the distribution system that connects the FSLs to the FOLs. Specifically, we discuss how a CSC2 system was implemented in a test of maintenance FSLs, more commonly known as centralized intermediate repair facilities (CIRF). The CSC2 system implemented during the CIRF test demonstrates the viability of the CSC2 process concepts outlined in the CSC2 TO-BE operational architecture.[2]

CSC2 Objectives

The CSC2 system is a pivotal element of the expeditionary concept, as it is responsible for coordinating the other components of the CS network. Joint and Air Force doctrine defines command and control (C2) as "the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission."[3] It includes the battlespace management process of planning, directing, coordinating, and controlling forces and operations. Command and control involves the integration of the systems, procedures, organizational structures, personnel, equipment, facilities, information and communications that enable a commander to exercise command and control across the range of military operations.[4]

Earlier RAND analysis further delineated required C2 capabilities, based on the support needs of expeditionary operations.[5]

- Generate support requirements based on desired operational effects.
- Provide support assessments quickly and continually and effectively communicate CS capabilities in terms of operational effects.
- Monitor resources in all theaters and allocate resources in accordance with global priorities.

C2 Combat Support

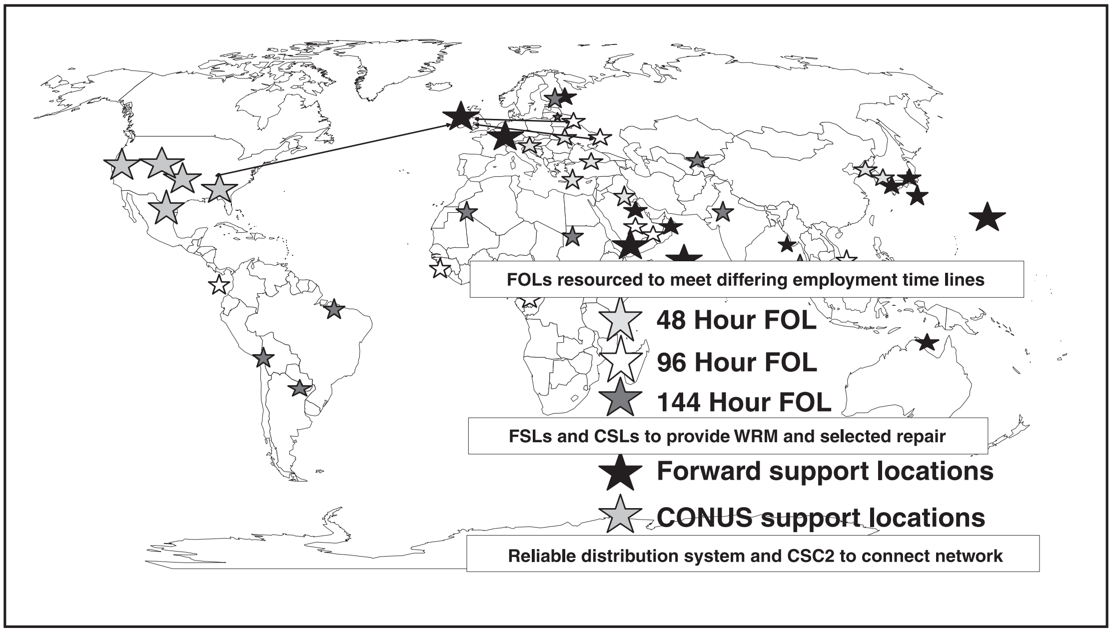


Figure 1. Elements of the ACS Concept

- Be self-monitoring during execution and able to adjust to changes in either CS performance or operational objectives.

Testing CSC2 Concepts in Maintenance FSL Operations

From September 2001 to March 2002, the Air Force developed and tested several CSC2 capabilities associated with the operation of maintenance FSLs, referred to by the Air Force as CIRFs. CIRFs are centralized repair locations that provide intermediate repair capabilities for selected components; for example, engines, electronic warfare (EW) pods, and avionics components. Before describing the CIRF test parameters, we will present a brief background of the events that led to the test in fall 2001.

CIRF History

The concept of centralized intermediate maintenance is not a new one and has been implemented in various forms throughout the Air Force since the Korean conflict. Much of this history is documented in this edition of the Air *Force Journal of Logistics*, as well as an upcoming RAND report.[6]

RAND's involvement with CIRF began with the onset of the ACS concept in the late 1990s. There are numerous options for positioning resources and processes at FOLs, FSLs, and CSLs, and each option has differing effects on operational effectiveness and support efficiency. Several analyses have modeled the FOL, FSL, and CSL interactions for individual commodities—including F-15 avionics,[7] low-altitude navigation and targeting infrared for night (LANTIRN) pods,[8] and JEIM[9]—and defined circumstances under which the concepts would be most successful. In each of these studies, a mix of FSLs and CSLs proved to have advantages over the current decentralized maintenance concepts, where each unit would deploy its own intermediate maintenance shops with the aviation units to the deployed site. The centralized maintenance and support concepts were briefed to senior Air Force leadership as early as 1997, and the United States Air Forces in Europe (USAFE) Director of Logistics expressed an interest in testing these ideas in 1998. However, the Air War Over Serbia began in 1999, before a formal test could begin.

CIRF Operations and Noble Anvil[10]

In 1999, USAFE adopted CIRFs (maintenance FSLs) for use in Joint Task Force Noble Anvil (JTFNA), the Air Force component of the Air War Over Serbia. While the Air Force maintained base repair in the CONUS, three overseas facilities already operating informally as maintenance FSLs were officially designated as CIRFs during Noble Anvil. This reduced intermediate-level maintenance deployment by approximately two-thirds, enabled rapid spinup of repair operations, and demonstrated that CIRFs were capable of supporting contingency operations. However, ad hoc augmentation of CIRF assets significantly delayed the arrival of needed resources. These delays raised several questions regarding CIRF implementation processes and procedures, including CSC2 issues of how organizations should communicate and assets should be managed to meet operational goals.

CIRF Test Background

Based on experiences in JTFNA, the Air Force Deputy Chief of Staff, Installations and Logistics directed further development and testing of several ACS concepts, including that of CIRFs. The test was developed to determine how well CIRFs, with a well-planned support system, could support steady-state operations.

The test involved five wing-level USAFE work centers functioning as CIRFs for engines, LANTIRN pods, EW pods, and F-15 avionics for units supporting Operations Northern Watch and Southern Watch. The USAFE Regional Supply Squadron (RSS) acted as the C2 decision authority and controlled the allocation of spare items throughout the theater. CIRF operations in the test took much from the RAND concept of maintenance FSLs but had several deviations as well.[11] In the test, when selected units deployed to Northern Watch and Southern Watch, they augmented CIRF staffing, equipment, and spares based on pre-established trigger points. The operational environment of the CIRF test is mapped in Figure 2.

The CIRF Test and CSC2 Operational Architecture

This article discusses CSC2 capabilities addressed throughout the CIRF test. The CIRF C2 structure was designed to provide a common operating picture and bring total asset visibility to decisionmakers at all levels, thereby improving support to the warfighter in both planning and execution activities. The common operating picture was to be leveraged in assessing the condition of deployed units to monitor the effectiveness of CIRF operations (based on customer wait time [CWT] and quality of repair), see if support operations should be modified, and monitor the inventory position of all units to see how the repair and spares capability should be allocated. These assessments were to be used to guide prioritization decisions and, in conjunction with Air Force operational goals, prioritize goals for weapon system availability and allocate resources accordingly.

These responsibilities link very closely with the planning and execution process outlined in the CSC2 TO-BE operational architecture and shown in Figure 3. This process begins, as shown on the left side of the figure, with the development of an integrated operational and CS plan. The jointly developed plan is then assessed to determine its feasibility, based on CS resource availabilities. Once the plan is determined to be feasible, it is executed. In the execution control portion of the process, shown in the lower right of the figure, actual CS process performance is compared to the control parameters identified as necessary to achieve the operational measures of effectiveness in the planning process. When a parameter measuring actual CS performance is not within the limits set in the planning phase, the process notifies CS planners that the process is *out of control,* and *get well* analyses and replanning are necessary.

This process centers on integrated operations and CS planning but also incorporates activities for continually monitoring and adjusting performance. A key element of planning and execution in the process template is the feedback loop that determines how well the system is expected to perform (during planning) or is performing (during execution) and warns of potential system failure. It is this feedback loop that tells the RSS support planners to act when the CS plan should be reconfigured to meet dynamic operational requirements, during both planning and execution. The feedback loop can drive changes in the CS plan and might call for a shift in the operational plan as well. Feedback might include notification of missions that cannot be performed because of CS limitations.[12] For the CS system to provide timely feedback to the operators, it must be tightly coupled with their planning and execution processes and systems and provide options that will result in the same operational effects, yet cost less in CS terms.

The C2 responsibilities defined in the CIRF test tie very closely to this process, as the resource allocation and prioritization of weapon system availability are both parts of the integrated planning process. Likewise, the common operating picture and comprehensive assessments of deployed units are necessary for the feedback loop that links the planning and execution phases.

CIRF Test Results

By most counts, the CIRF test showed centralized maintenance operations to be an effective step toward a global ACS framework. The CIRF supported all deployed sorties at a reduced deployment footprint. The regional supply squadron provided responsive decisionmaking capability; logistics costs and requirements were reduced; and the pre-established trigger points, with few exceptions, successfully supported operations. Procedures and performance standards were established in advance, based on operational needs, and used to measure performance and guide operations throughout the test. For example, while support operations and spares inventories occasionally fell short of the standards set at the beginning of the test and necessitated loaners from other units, the ability of units to recognize when operations were falling short and provide the necessary resources demonstrates the effectiveness of the pre-established performance standards and feedback loops. However, as CIRF implementation progressed, opportunities to improve operations were uncovered. There were several instances of processes, chains of command, and information systems not being defined for situations that arose. In this section, we detail the achievements of the CIRF test, with respect to the four C2 objectives discussed earlier.

C2 Objective 1. Generate Support Requirements Based on Desired Operational Effects

In the CIRF test, a primary goal of the concept was to meet the sortie requirements of Northern Watch and Southern Watch. The RSS personnel—composed of maintenance, transportation, and supply planners—used these sortie requirements and projected flying hours to determine FOL spare levels and performance standards for transportation times, maintenance times, and all other components of customer wait time.

As illustrated in Figure 4, CIRF planners used operational sortie generation and weapon system availability objectives to establish control parameters for CS performance—including expected unit component removal rates, transportation times to and from the CIRFs to the operational locations, CIRF repair times, inventory buffer levels; for example, contingency high-priority mission support kit levels and other parameters—and tracked actual *logistics pipeline* performance against these control parameters.[13]

The bottom of Figure 5 shows some of the CS process control parameters monitored during the CIRF test. The top half of the figure shows how two parameters associated with customer wait times, one from the CIRF to deployed units and the other from

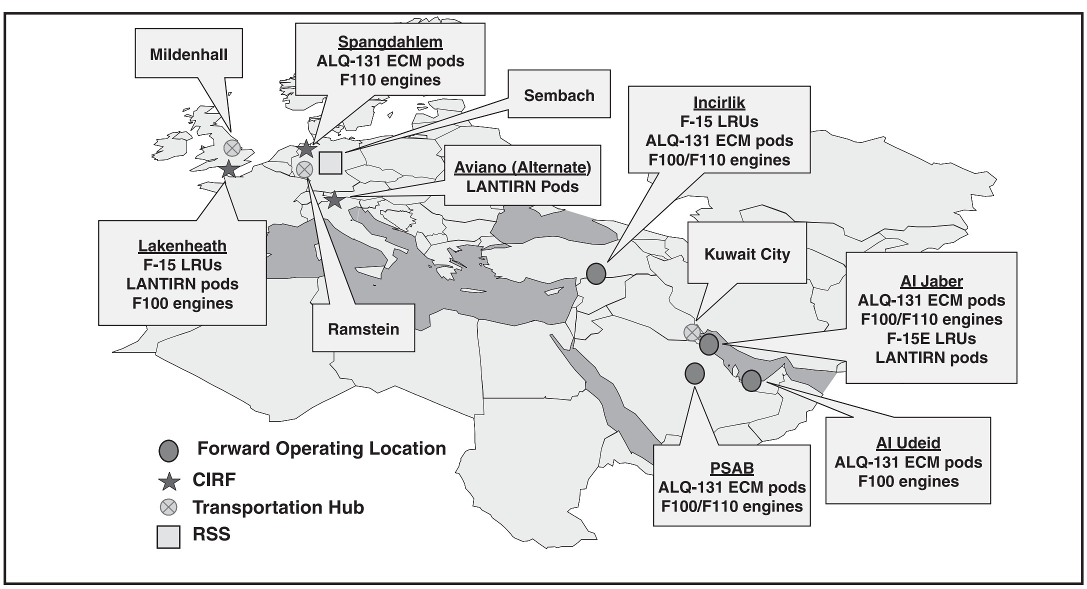


Figure 2. CIRF Test Operational Environment

depots to the CIRFs, were monitored against *trigger points* or control limits. The CWT control graphs show the percentiles of total customer wait time for a number of FOLs for a 3-month period in Enduring Freedom.

The performance threshold lines on the figure illustrate how the C2 system might indicate if a control limit were breached and the theater distribution system (TDS) performance or strategic resupply system were out of control and had the potential to affect weapon system availability objectives. This comparison of support performance to the control parameters established from operational goals took place during the Enduring Freedom CIRF test. Personnel at the USAFE Regional Supply Squadron monitored transportation, maintenance, and supply parameters and compared them to those needed to achieve operational weapon system availability objectives, as shown on this figure.[14]

When the performance of the theater distribution system was out of tolerance with these, RSS personnel indicated how this performance, if left uncorrected, would impact future operations and were able to do this before the negative impacts actually occurred.

Another example of the CIRF test's link between operational and support performance was seen when determining spare levels at each FOL and process performance parameters for the CIRF. Support thresholds set in the CIRF test plan were later verified using a simulation model, which simulated a unit's flying schedule and associated base and CIRF processes to track daily spare engine and pod inventories at each base and in CIRF processes associated with intermediate repair operations over the duration of the Northern Watch and Southern Watch scenario.[15]

To verify the target set in the CIRF test, we used the simulation model and held all operational requirements constant. We then varied support performance incrementally. For example, for a given sortie profile, we examined how variations in transportation performance or removal rates might affect spares levels at the FOLs. In this manner, we could establish threshold values for process performance parameters and verify that targets set at the beginning of the CIRF test were adequate to achieve operational goals. The Air Force has recommended similar CWT goal development for other mission-design series and commodities.

Using these techniques, we also were able to observe interactions among performance parameters—for example, removal rates and customer wait time—and how they would impact operational performance (that is, sortie generation capability). For example, at low engine-removal rates, 1- or 2-day variations in the customer wait time for engines sent to the CIRF do not have a significant impact on operational readiness. With fewer removals, the time each engine spends in repair is not as noteworthy, since, unless CWT increases by an order of magnitude, additional engines are still unlikely to break in the time that the original engine is gone. However, at higher removal rates, with more engines sent to the CIRF, the time each engine spends not mission capable has a much greater impact on spare

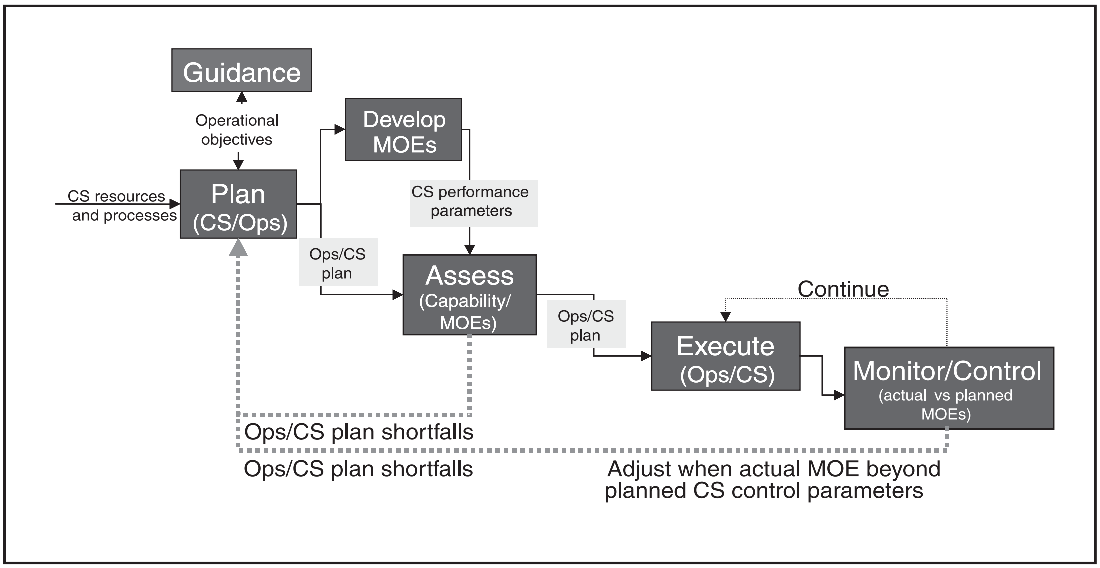


Figure 3. CSC2 TO-BE Closed-Loop Process Used to Control Fighter CIRF Operations During the CIRF Test

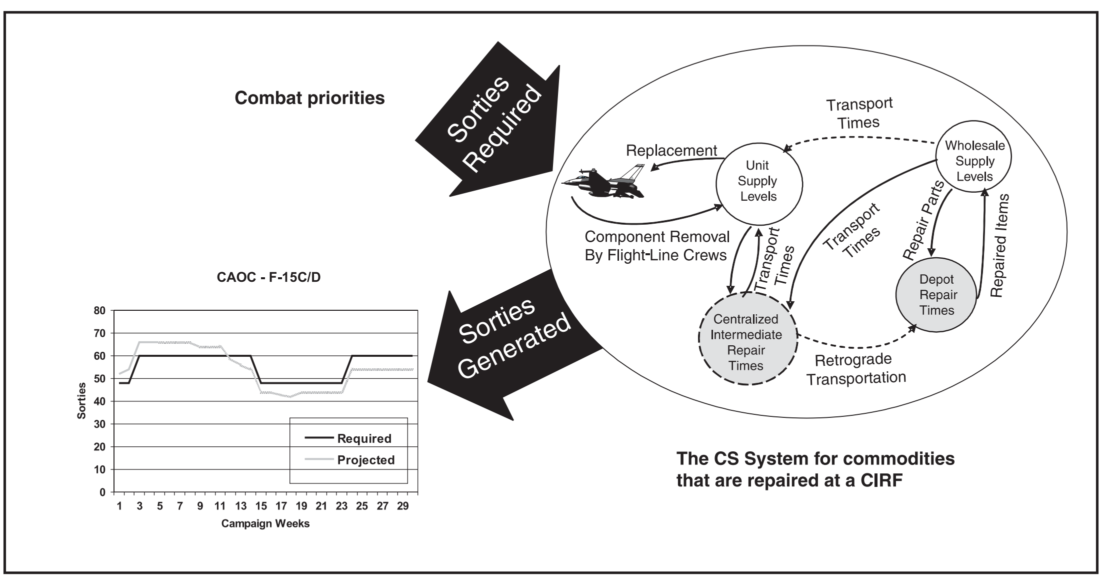


Figure 4. CS Performance Parameters Were Related to Operational Measures of Effectiveness

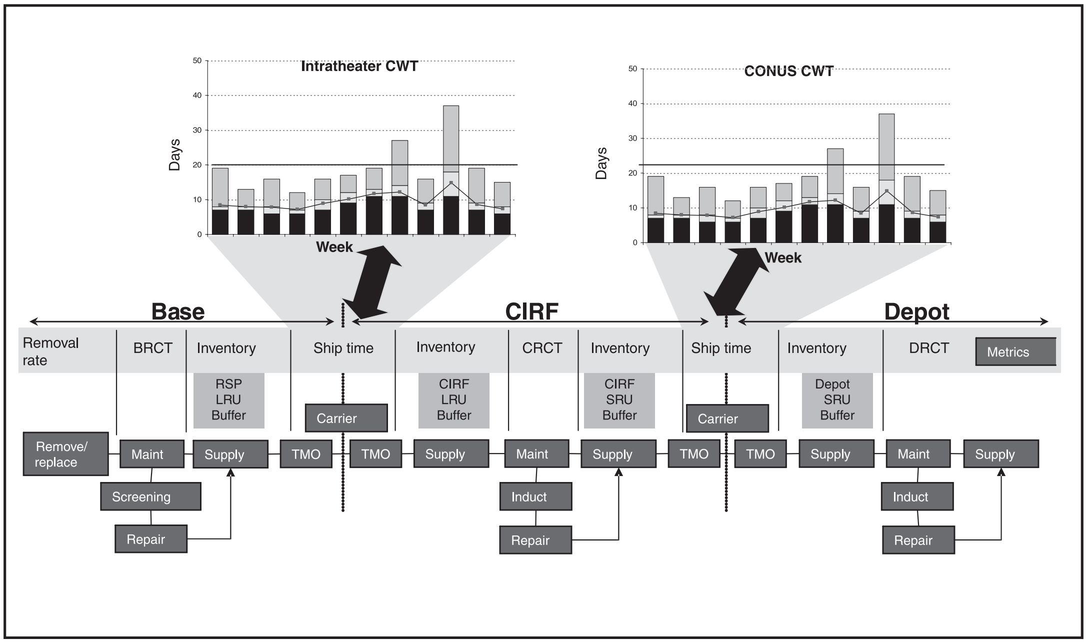


Figure 5. Actual Process Performance and Resource Levels Were Compared to Planned Values

parts inventories and the ability for units to meet their sortie requirements.

C2 Objective 2. Provide Support Assessments Quickly, Continually, and Effectively and Update and Communicate Status Reports

One of the key enablers of access to status reports and quick and effective support assessments is the CIRF staff's ability to provide a common operating picture. During the CIRF test, this common operating picture was provided through the Air Force portal. At the time of the CIRF test, the portal had four modules: Fleet Engine Status, Fleet Engine Trending Report, Fleet CIRF Engine Status, and Fleet Pod Status. Further information on the capabilities of each module is provided in "CIRF Toolkit: Developing a Logistics Common Operating Picture."[16] This information system provided the status of each engine and pod at each unit and the availability status of transportation resources, allowing units to anticipate when they would get repaired parts back.

The CIRF portal also enabled immediate transfer of information and automatic aggregation of information from a central database. This ensured that once a part was repaired, shipped, or delivered its status would be updated and allocation and prioritization decisions would be made from the most current information possible.

After the CIRF toolkit was completed in January 2002, it was first implemented by USAFE, Air Combat Command, and the Pacific Air Forces and received positive feedback from maintenance personnel. Air Mobility Command (AMC), Air Force Special Operations Command, Air Education and Training Command, Air National Guard, and Air Force Reserve Command users were to be added next, with the anticipation of reducing the reporting workload throughout the CIRF community by 25 percent.

However, throughout the CIRF test, several opportunities for improvement were also noted. While the toolkit facilitated the sharing of data across organizations, there was also valuable information not incorporated. For example, the portal did not contain complete information about engines and pods while they were in repair. Furthermore, this information was not only not included in the portal but also not centralized at positions within the CIRF. During the test, there was no point of contact established for unit status. As a result, deployed units called several people in the propulsion flight for information. This led to problems on multiple fronts. Fielding questions not only distracted CIRF personnel from their primary responsibilities but also resulted in conflicting reports when the same question was posed to more than one person.

Similarly, while the CIRF toolkit contained the status of each engine and pod, during the test, it did not provide this information as a unit status report. As a result, it was difficult to provide feedback on a unit's capability or on what its needs might be. This made it more difficult for the regional supply squadron to allocate effectively. The portal also provided very little information on changes to units' taskings. The CIRF staff was, therefore, caught shorthanded at points throughout the test, when taskings were changed and units deployed with a greater workload or fewer augmentees than expected. To correct these deficiencies, the Air Force Maintenance Management Division has recommended continuing the development of the CIRF toolkit and using the toolkit to formalize the tracking of engines and pods.

C2 Objective 3. Monitor Resources in all Theaters and Allocate in Accordance with Global Priorities

As the decisionmaking authority of the CIRF test, the USAFE Regional Supply Squadron monitored resources in the European Command (EUCOM) and Central Command (CENTCOM) theaters. The regional supply squadron combines the supply C2 responsibilities of mission capability management, stock control, stock fund management, information system management, operational assessment and analysis, and reachback support procedures with the transportation C2 responsibilities of shipment tracing and tracking, source selection, traffic management research, movement arrangements, shipment expediting, customs issues, and channel requirements. The organization is designed to interface with the maintainers at the CIRF to provide "combatant commanders…with operational materiel distribution C2 and regional weapon system support" and provide a comprehensive picture of the CIRF's needs.

The integrated nature of the regional supply squadron allowed the CIRF to provide responsive support to the deployed units. However, some holes in C2 presented challenges. The USAFE Regional Supply Squadron had the authority to distribute parts to both EUCOM and CENTCOM forces, despite their being different theaters. As a result, the USAFE Regional Supply Squadron was unfamiliar with the full spectrum of CENTCOM theater issues. Furthermore, the regional supply squadron faced some difficulties in resource allocation. Lack of clearly defined decision processes and command relationships forced the regional supply squadron to coordinate among deployed units, CIRFs, and MAJCOMs about personnel, equipment, status, funding, and transportation. Many of these issues were out of the RSS area of responsibility, and the regional supply squadron did not have the authority to set policies or determine resource allocation.

CIRF operations also raised issues of prioritizing support to USAFE *home* units that hosted CIRF and deployed units. When deployed units faced shortages, home wings often were forced to provide their resources as loaners. In these circumstances, their home support could potentially be degraded. Although the needs of the deployed units were generally given higher priority than those of the home units, care needs to be given to ensure that home-station support does not impact the training capability and, thus, place the Air Force at risk of being unable to respond to additional conflicts.

The lack of definition in command relationships was just one manifestation of the difficulties the CIRF faced in resource allocation. Although the regional supply squadron performed well as the CIRF decision authority, decision rules for cross-theater support were not yet fully developed at the time of the test. Maintenance and part requirements often were renegotiated throughout the course of operations. Because the CIRF was often not prepared for these added requirements, additional capability needed to be deployed. Augmentation presented many challenges as well, since augmentee unit type codes had not been defined at the start of the test and staff needed to be pulled in by unit line number instead. Furthermore, to moderate the delays caused by the augmentation process, many man-hours were spent trying to provide an added capability from the CIRF home wings. CIRF wings often were forced to provide their own resources as loaners, leading to further complications, as touched on above. Home-station support was compromised, support was degraded, assets became tied up in AWP status, and tracking of funds was complicated. Finally, although CIRF-wing line-replaceable units were authorized with the same Joint Chiefs of Staff project code as those of deployed units, this authorization was not universally understood.

C2 Objective 4. Be Self-Monitoring and Adjust to Changes in Operational Needs and Support Performance

One key to the success of the CIRF test was the clear definition of support goals and the ability of CIRF staff to monitor their own performance and make corrections when the goals were not being met. For example, as part of the Strategic Distribution Management Initiative (SDMI), transportation planners monitored the customer wait time of each item sent to the CIRF, through each stage of the repair process. They could, therefore, determine when customer wait time exceeded the target times and examine their transportation processes to see how resources could be put to better use. Throughout the CIRF test, the tanker airlift control center (TACC) at AMC provided qualitative feedback to USAFE, the US Transportation Command (USTRANSCOM), and other organizations on issues underlying the SDMI CWT statistics. This feedback allowed transporters to take corrective actions when needed, as was the case in the use of C-130s in CIRF transportation. Originally, USAFE was using a combination of trucks and C-130s to move cargo to the CIRF. C-130s were often available, and planners were concerned that they would otherwise fly empty, wasting valuable airlift capacity. However, channel routes for C-130s were unpredictable, and the cargo waiting for airlift could at times have been shipped faster by truck. TACC reports highlighted this issue and relayed concerns to USAFE, who ultimately shifted to a truck-only policy.

Another example of the C2 responsiveness in the CIRF test dealt with TDS performance to Al Jabar Air Base in Kuwait. Transportation times were consistently above the CWT performance criteria of 4 to 6 days to allow support of EW pods and LANTIRN to this location. The RSS personnel worked with AMC and USTRANSCOM personnel to improve TDS performance to this location, but the customer wait time could not be improved with resources that USTRANSCOM was willing to allocate to the theater distribution system. As a result, the regional supply squadron and deployed unit personnel made the decision to deploy EW and LANTIRN repair capability to Al Jabar during the Enduring Freedom CIRF test.

Use of this CSC2 process during the CIRF test represented a significant improvement in CSC2. These concepts and associated doctrine and educational programs that fully describe the process are being established to implement these concepts across a wide variety of CS processes Air Force-wide.

Despite these capabilities, the CIRF test revealed opportunities for further improvement to feedback capabilities. Limitations in information systems presented challenges in forecasting and information transfer. For example, the CIRF toolkit did not have a simple way to provide feedback on the status of units. Information was tracked by engine and pod serial number, which made it difficult to aggregate records to the unit level. In addition, the two information systems used in requirements forecasting, GATES and Brio, are under study to improve forecasting capabilities. The ability of the CIRF staff to predict cargo arrival and plan accordingly is dependent on the accuracy of these systems.

Even if feedback was given, CIRF planners still had difficulties using this information to adjust their operational and support plans. For example, if assets sent to the CIRF were missing components or had problems not described in their accompanying documentation, CIRF staff did not always have channels through which to follow up. In the event these discrepancies needed to be investigated before repair could proceed, the lack of accountability led to an increase in customer wait time. This lack of documentation also made it difficult to investigate foreign object damage or equipment abuse possibilities and did not provide a way to incorporate these issues into policies and plans.

Going Forward: Implementing C2 Changes

Changes to Air Force operational and CS processes and the C2 elements supporting them (that is, doctrine and policy, organizational relationships, training, and information systems) will allow the Air Force to better meet each of its C2 objectives. Some steps that may be taken to improve the C2 network are described below.

Organizational Changes

As discussed above, many of the CSC2 tasks are currently performed by the USAFE Regional Supply Squadron to manage the CIRF. These C2 features of the regional supply squadron can be accessed *virtually* by the COMAFFOR A4. These functions can be done from the COMAFFOR A4 Rear in a reachback fashion by a *permanent and standing* operations support center that would receive *virtual* inputs from the regional supply squadron with respect to CIRF operations. This will leave the regional supply squadron to focus on the daily supply operations of the CIRF and the rest of its theater and allow the operations support center to have visibility of spares involved in this operation, as well as spares supported by other processes and resources needed to initiate and sustain operations. Operations support centers should have visibility of theater resources and the ability to work with the Air Force and joint communities to ensure these allocations are in accordance with theater and global operational priorities. The operations support centers should report to the theater AFFOR/A-4 and communicate with inventory or commodity control points and the Air Staff Combat Support Center. The Combat Support Center should have responsibility for providing integrated weapon system assessments across commodities. It will have the capability to support allocation decisions when multiple theaters are competing for the same resources.

Each of the operations support centers and the Combat Support Center should have clear channels of communication with the deployed units, with the CIRF, and among each other.[17]

Information Sharing

Another important aspect of command and control is the successful sharing of information. The CIRF toolkit could be expanded to include the status of engines and pods in repair and aggregate status reports to provide information by unit. In addition, all operations, support, and C2 nodes (that is, the regional supply squadron, CIRF, and deployed units) could establish points of contact to provide all parties involved with a common operating picture.

Similarly, procedures should be instituted to inform these nodes of changes to deployments. The AEF Center and MAJCOMs should inform the nodes when the deployment packages change, either through the CIRF toolkit or other established channels. The operations support center can then task additional CIRF augmentees and enable the CIRF to allocate spares accordingly. The CIRF staff also should have a feedback channel for cases where deployed assets and equipment are broken, incomplete, or not properly documented. This will allow units to correct their deployments and explore root causes of these discrepancies.

Doctrine, Policy, and Training

Based on the success of the CIRF test, the Air Force is proceeding with further implementation of the CIRF concept. To assist in this implementation, CIRF scenarios could be incorporated into Air Force and joint policy. The Air Force Maintenance Management Division; Materiel Management and Policy Division; Deployment and Distribution Management Division; and Planning, Doctrine, and Wargames Division have been tasked with incorporating CIRF procedures into Air Force Doctrine Document (AFDD) 2-4, *Combat Support*; Air Force Instruction (AFI) 21-101, *Aerospace Equipment Maintenance Management*; Air Force Manual 23-110, *USAF Supply*; and AFI 24-201, *Cargo Movement.* This will involve revising spare item allocation standards and defining manpower and support unit type codes that can be used in a centralized maintenance scenario. In addition, further study of CIRF scenarios—to identify deployment requirements, performance standards, and other resource needs—could enhance operations. More specifically, the Air Force has tasked the USAFE Maintenance, Supply, and Transportation Directorates with evaluating the CWT goals and reassessing them every 6 months. This will keep transportation performance standards current with changing operational objectives.

Summary

The CIRF test provided an opportunity to not only study the implementation of CIRFs but also test the many C2 concepts that enable this implementation. Over the 6 months of CIRF test operations, the centralized repair and decisionmaking organizations performed effectively and were able to meet each of the four objectives established in the C2 architecture. However, there were also several areas in which shortfalls were noted. Standardizing organizational roles and responsibilities, process and information requirements, and channels of communication will further improve command and control and enable smoother implementation of future CIRF operations.

Notes

1. For a full definition of the five basic components of the ACS infrastructure, see Robert S. Tripp, Lionel Galway, Paul S. Killingsworth, Eric Peltz, Timothy L. Ramey, and John Drew, *Supporting Expeditionary Aerospace Forces: An Integrated Strategic Agile Combat Support Planning Framework*, RAND, MR-1056-AF, Jan 99, and Robert S. Tripp, Lionel Galway, Timothy L. Ramey, Mahyar Amouzegar, and Eric Peltz, *A Concept for Evolving the Agile Combat Support/Mobility System of the Future*, RAND, MR-1179-AF, 2000.
2. James A. Leftwich; Amanda Geller; David Johansen; Tom LaTourrette, Patrick Mills; C. Robert Roll, Jr; Robert Tripp; and Cauley von Hoffman, *Supporting Expeditionary Aerospace Forces: An Operational Architecture for Combat Support Execution Planning and Control*, RAND, MR-1536-AF, 2002.
3. Joint Pub 1-02, *DoD Dictionary of Military and Associated Terms*, 12 Apr 01.
4. AFDD-1, *Basic Air Force Doctrine*, 1 Sep 97.
5. Summarized from Leftwich, et al, *An Operational Architecture for Combat Support Execution Planning and Control*, MR-1536-AF, RAND, 2002.
6. Amanda Geller, et al, *Supporting Air and Space Expeditionary Forces: Analysis of Maintenance Forward Support Location Operations*, RAND, forthcoming 2003.
7. Eric Peltz, Hyman L. Shulman, Robert S. Tripp, Timothy L. Ramey, and John G. Drew, *Supporting Expeditionary Aerospace Forces: An Analysis of F-15 Avionics Options*, RAND, MR-1174-AF, 2000.
8. Amatzi Feinberg, Hyman L. Shulman, Louis W. Miller, Robert S. Tripp, *Supporting Expeditionary Aerospace Forces: Expanded Analysis of LANTIRN Options*, RAND, MR-1225-AF, 2001.
9. Mahyar A. Amouzegar, Lionel A. Galway, Amanda Geller, *Supporting Expeditionary Aerospace Forces: Alternatives for Jet Engine Intermediate Maintenance*, RAND, MR-1431-AF, 2001.
10. A complete RAND analysis of JTFNA is provided in Amatzia Feinberg; Robert S. Tripp; James A. Leftwich; Eric Peltz; Mahyar Amouzegar; Col Russell Grunch; CMSgt John Drew; Tom LaTourrette; and Charles Robert Roll, Jr, *Supporting Expeditionary Aerospace Forces: Lessons from the Air War Over Serbia*, RAND, MR-1263-AF, 2002.
11. The Air Force did not centralize maintenance in CONUS, the potential for which was discussed in MR-1174, MR-1225, and MR-1431. Instead, the CIRF test was based on CIRFs implemented to support overseas deployments and contingencies. The units maintained base maintenance in CONUS.
12. Leftwich, et al.
13. Methods on how to derive logistics performance parameters from operational metrics for reparable components have been known for some time. See such articles as Robert S. Tripp, "Measuring and Managing Readiness: The Concept and Design of a Wartime Spares Push System," *Logistics Spectrum*, Vol 17, No 2, Summer 1983; Robert S. Tripp and Raymond Pyles, "Measuring and Managing Readiness: An Old Problem—A New Approach," *Air Force Journal of Logistics*, Spring 1983; and other publications on Dyna-METRIC and the Weapon System Availability Model.
14. The RSS personnel were performing a COMAFFOR A4 function as outlined by the CSC2 operational architecture. These personnel could be considered to be a virtual extension of the UTASC, an operations

(Continued on page 46)

Major Lisa Hess, USAF

Expeditionary Leader Development

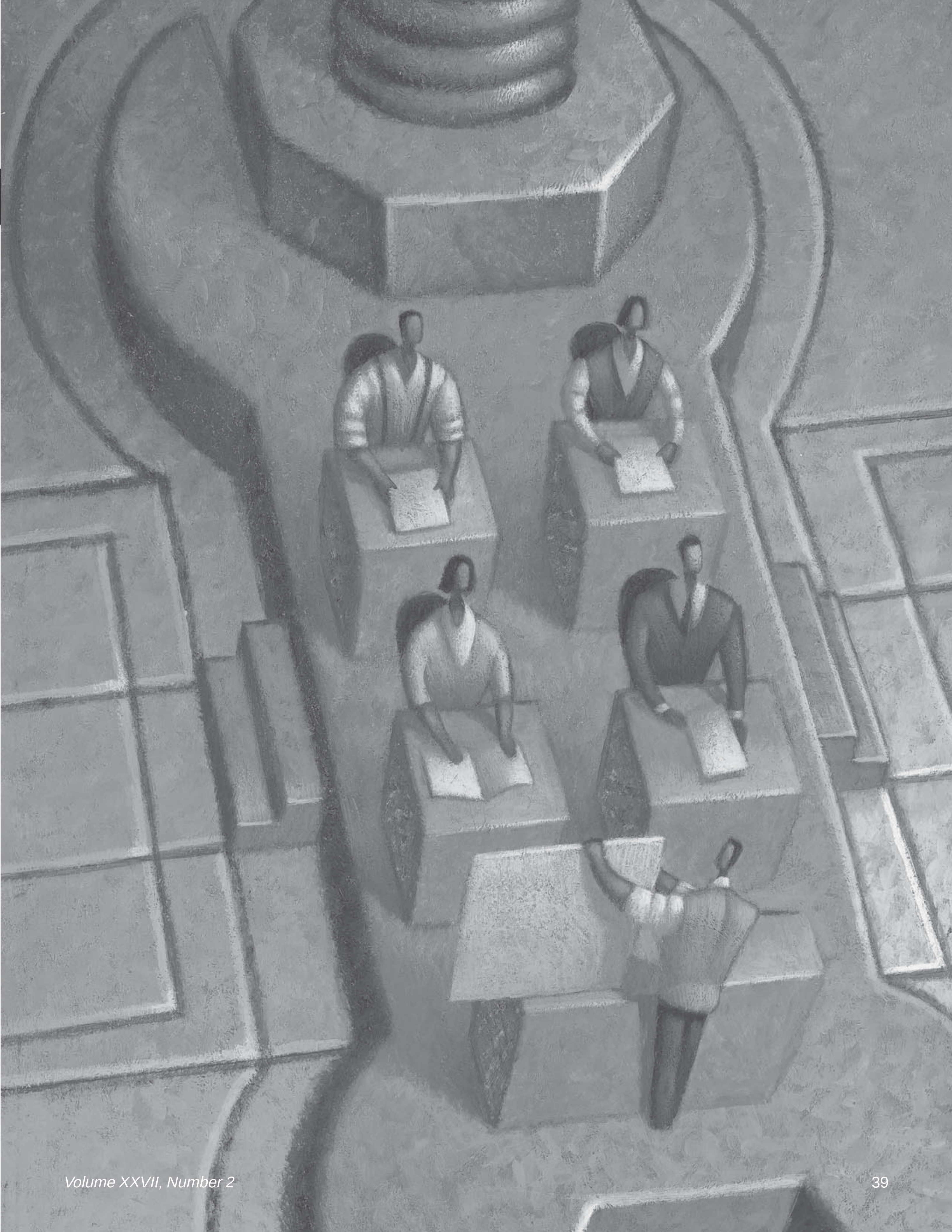
Lieutenant General Michael E. Zettler, Deputy Chief of Staff, Installations and Logistics, described "our Air Force today [as] expeditionary, and our prime operating environment is in a deployed state." The change to the new combat wing organization and the requirement to develop a combat support command and control (CSC2) operational architecture led the Air Force Chief of Staff—through the Air Force Deputy Chief of Staff, Installations and Logistics; Agile Combat Support (ACS) Executive Steering Group; and Colonels Advisory Group—to address the training and leadership processes of doctrine, organization, training and education, materiel, leadership, personnel, and facilities (DOTMLPF).

There are numerous initiatives to ensure we now *grow* mission support group (MSG) commanders, as well as other combat support (CS) colonels, to command and control (C2) in an expeditionary environment, both at and above wing level.

The MSG Commanders Course and the new Expeditionary Combat Support (ECS) Executive Warrior Course will provide training for MSG commanders, potential expeditionary MSG commanders, and A-4s. Eagle Flag will provide the final field training exercise for CS personnel prior to their air and space expeditionary force (AEF) rotation and give them the opportunity to test their ability to open and establish an airbase and provide initial command and control. On the academic side, one of Air Command and Staff College's (ACSC) eight new specialized studies will provide an overview of Agile Combat Support for officers and civilians within and outside the ACS community. The Air Force Institute of Technology is revamping short courses to be in line with the new combat wing organization and logistics processes. Finally, the Advanced Logistics Readiness Officer Course will provide a special logistics expertise to the warfighter.

The following paragraphs describe these initiatives in greater detail.

- **Eagle Flag, Air Mobility Warfare Center (AMWC), Ft Dix, New Jersey.** Eagle Flag's mission is to exercise opening and establishing an airbase to initial operating capability and provide initial command and control. Air Force lessons learned indicate we can open and establish bases, but it is often on the backs of our great CS warriors, who learn as they go. Through a combination of doctrine (the Global Mobility Concept of Operations [CONOPS], ACS CONOPS, and training [Eagle Flag]), we can reduce the footprint for this mission while having a new airfield ready for mission forces in record time. Eagle Flag will consist of 29 functional areas. It is a 1-week, fully integrated field training exercise, with the first scheduled for 13 October 2003. Down the road, Eagle Flag may be expanded to be conducted in the Nevada desert and integrated into Red Flag, Blue Flag, or other operations and C2 exercises. Like its operations counterpart (Red Flag), Eagle Flag is an opportunity to open and establish a base in a learning environment before deploying. "A field-training exercise completes the [AEF preparatory] training by integrating all [combat support] specialties into one military operation striving toward a single mission" says Major General Timothy A. Peppe, special assistant to the Chief of Staff of the Air Force for AEF.
- **MSG Commanders Course, Maxwell AFB, Alabama**. The Logistics Group Commander and Support Group Commander Courses have



transitioned to Maintenance Group Commander and MSG Commanders Courses at Air University (AU). These courses traditionally have focused on peacetime and home-station issues. AU added expeditionary flavor to the MSG Commanders Course by providing experienced expeditionary commanders for panels, an ECS training session, and additional expeditionary focus from guest speakers.

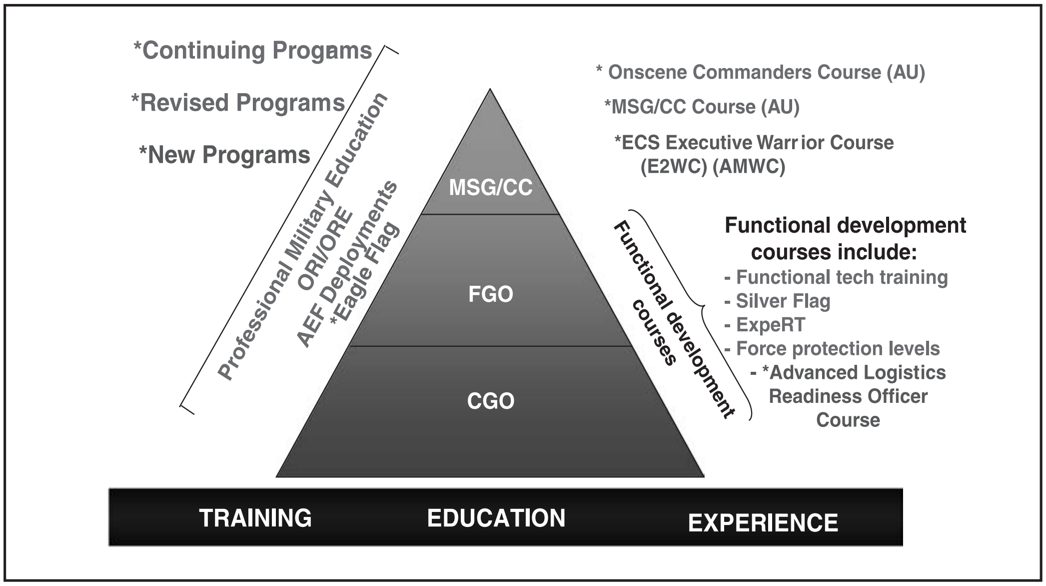


Figure 1. ECS Leader Training and Development

- **ECS Executive Warrior Course, AMWC, Ft Dix, New Jersey**. This new course will stand up in January 2004 for potential expeditionary MSG (EMSG) commanders and A-4s to provide more extensive expeditionary training at the operational level of war. It consists of three parts: a mentor's bureau, a 1-week seminar, and a quick reference handbook. The mentor's bureau provides potential expeditionary group commanders and A-4s access to graduated counterparts for guidance. These *mentors* also may assist or sit on panels during the seminar, which will address hot topics, trends within combat support, and lessons learned. Topics would likely include the en route system, reachback supply, deployment preparation, and opening and establishing a base. The quick reference handbook provides information for the deployed group commander or A-4.
- **Advanced Logistics Readiness Officer Course, AMWC, Ft Dix, New Jersey**. This advanced course came from a Corona decision to create highly skilled operational logistics readiness officers competent in ACS command and control and experts on ACS and ECS processes. The course will provide warfighting commanders with officers who possess special expertise in the application of expeditionary logistics and the ability to leverage effects-based logistics to improve combat capability. The course will focus on the ACS processes of Ready the Force, Prepare the Battlespace, Position the Force, Employ the Force, Sustain the Force, and Recover the Force. The target audience will be fully qualified logistics readiness officer captains with 6-8 years of service. Those completing this course will be targeted for key positions in logistics readiness squadrons, wing combat support centers, A-4/A-5, air operations centers, regional supply squadrons, and other CSC2 nodes. They will be highly skilled logisticians capable of not only providing combat support to air expeditionary forces and warfighting commanders but also instructing unit level logistics officers and advising senior commanders. The first class is scheduled for February 2004.
- **ACSC Agile Combat Support, Maxwell AFB, Alabama**. At Corona Fall 2002, the Air Force adopted a new vision for *deliberate personnel development*, and in November 2002, the Chief of Staff released the force development construct. It is designed to link our education, training, experiences, promotions, and assignment policies and programs to force requirements and institutional needs. Currently, ACSC is approximately 10 months long with two semesters, focusing on international security; military studies; and leadership, command, and communications studies. The new ACSC course contains three modules. The first two are focused on strategy and airpower, leadership, and joint warfighting. The third will provide specialized studies, which will run for 7 weeks. Two weeks will focus on command, and the other five will be devoted to specialized professional development. Courses being developed for the specialized study program are Air and Space Power Employment, Plans and Programs, Acquisition Management, Political-Military Strategist, Space Operations, Mobility Operations, Information Operations, and Agile Combat Support. The audience of the ACS course is expected to consist of personnel from multiple Air Force specialty codes with follow-on assignments to an Air or Joint Staff within the ACS community or an assignment in a base-level maintenance support group, maintenance group, or wing staff. ACS CONOPS master processes will provide the outline for the course: Ready the Force, Prepare the Battlespace, Position the Force, Employ the Force, Sustain the Force, and Recover the Force. The curriculum will include expeditionary, as well as in-garrison, education. Case studies, classroom instruction, and field trips will round out the education.

As these programs are developed, processes are being put in place to ensure tactics, techniques, and procedures are updated; lessons learned are incorporated into training; and doctrine is continuously improved. The next push in the leadership pillar of DOTMLPF is to incorporate more CSC2 into exercises, wargames, and experimentation.

Major Hess chairs the ECS Training Working Group, consisting of ECS functional managers from the Air Staff. She is assigned to the Planning, Doctrine, and Wargames Division, Directorate of Logistics Readiness, Air Force Installations and Logistics.

Agile Combat Support—the Concept
Doctrine and Combat Support C2

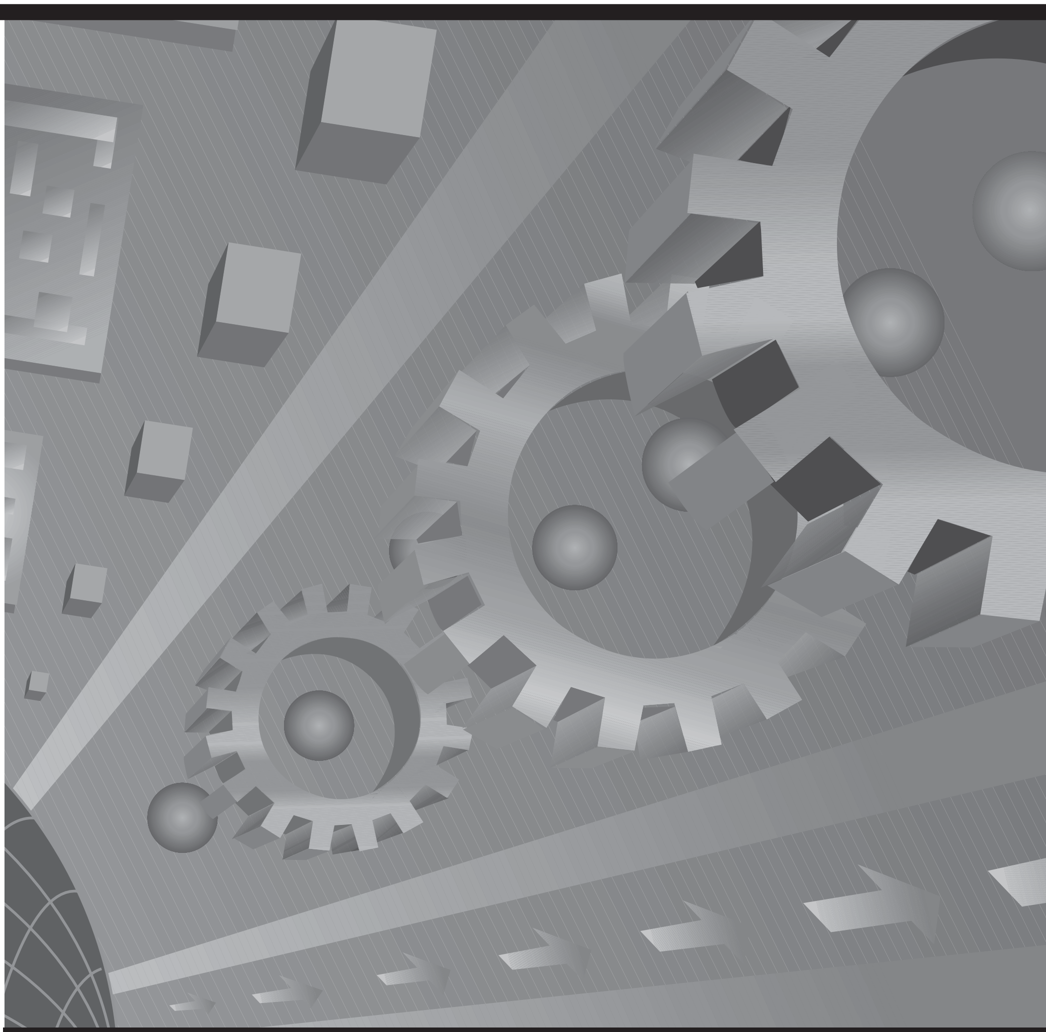
combat support features

ACS is recognized as the product of processes that effectively ready and prepare our forces for quick response and efficiently sustain an operational activity with the right resource at the right place, at the right time, and for the right length of time.

We have not done an effective job of translating lessons learned into doctrine, which leads us to repeat our mistakes or fail to pass our successes from one operation to the next. To improve CS doctrine, we must institutionalize a process that allows us to capture lessons learned; test potential solutions to identified problems and successful innovations through wargames, experiments, exercises, or field tests; and then translate concepts that can be implemented into doctrine.

In 1999, the Chief of Staff called for a concept for agile combat support, the effect of which was to produce and sustain mission capable air and space forces ….

Agile Combat Support The Concept



Colonel Connie Morrow, USAF, and Pat Battles

The Air Force defines airpower transformation as a fundamental change involving the integration of three elements:

> Advanced technologies providing a new capability, new concepts of operation (CONOPS) producing order-of-magnitude increases in our ability to achieve desired effects, and organizational change to codify changed CONOPS.[1]

The Air Force has a long history of transformational thought; some may say we have been transforming since before our creation as a separate force. Indeed, the Air Force was born of one of the most transformational operational concepts in the history of warfare: independent airpower. As Secretary of the Air Force James G. Roche has said:

> [Transformation] is a philosophy—a predisposition to exploring adaptations of existing and new systems, doctrines, and organizations. It has been part of the total Air Force for decades . . . it is an approach to developing capabilities and exploring new concepts of operation that allow us to be truly relevant in the era in which we find ourselves, and for years to come.[2]

The CONOPS that shapes how the combat support (CS) communities address the challenge of transforming to meet the demands of our era is the Agile Combat Support (ACS) concept of operations.

No one would disagree that Air Force CS capabilities have come a long way in 60 years. This transformation began under the umbrella of the Cold War and continues to this day. During the Cold War, our national security strategy called for significant forward presence; there was a degree of confidence about our enemy and the likely courses of action. The proximity of the threat demanded an *in place* response capability. Because parts were cheap, transportation was expensive, and we had years to develop CS infrastructures, we prepositioned both fighting forces and large stocks of dedicated war reserve materiel to meet the responsiveness requirements. Our Korean conflict CS concept was to take everything, not because we planned for any particular support requirements from the commanders but because we had no idea when or how we would be resupplied. As the political environment changed, our military requirements adapted. The Gulf War marked a change

ACS IS THE PRODUCT OF PROCESSES THAT EFFECTIVELY READY AND PREPARE OUR FORCES FOR QUICK RESPONSE

in both our operating and support concepts; we moved into a new theater in a relatively short period of time, creating new operating locations. Straddling the old and the new, we moved what has been referred to as an iron mountain of Cold War capability forward to prosecute the Desert War. We needed every bit of the 6 months it took to prepare for the first Gulf War, and we came away with volumes of lessons learned. By the late 1990s, as we entered the Air War Over Serbia, some of those lessons began to pay dividends.

The concept of an ACS capability began to take shape in the Air War Over Serbia, an operation foreshadowing our 21st century air and space expeditionary force (AEF). For the first time, US air forces were first in and constituted the preponderance of force in a theater. Our CS professionals were called on to manage theater distribution and provide combat support from 22 new operating locations. Another major change in the way the Air Force provided forces was the transition from generating sorties from long-established forward operating locations to the projection of a continental United States (CONUS)-based capability into regions with little or no existing infrastructure. During the Air War Over Serbia, we demonstrated one of our more basic needs was the capability to create an operating base—quickly. Today, we know this capability to open and establish an airbase is as much an operational necessity as the basic projection of combat airpower. In Operation Iraqi Freedom, our forces operated out of 32 austere bases, which were opened and established in a matter of days.

At the close of the 20th century, the Air Force was ready for the AEF concept to debut. To meet the dawning challenges, the Chief of Staff called for a comprehensive logistics review and a corresponding concept for a capabilities-based vision of Agile Combat Support. The vision was to transform CS capabilities to produce a more flexible force. Basic tenets of the original concept were the exploitation of technology, an increase in our ability to protect our forces, a more effective organization to CS command and control (C2) forces, and a reduction of the deployment footprint through reachback and CS regionalization. In 1999, the Chief of Staff called for an ACS CONOPS to produce and sustain mission-capable air and space forces.

Today, ACS is recognized as the product of processes that effectively ready and prepare our forces for quick response and efficiently sustain an operational activity with the right resource at the right place, at the right time, and for the right length of time. In warfighting terms, combat support is the science of planning and carrying out the movement and maintenance of forces. This definition of combat support is distinctly separate from the activities we label as operations or those functions that employ combat capabilities. Combat support and operations, together, create combat capability.

Our doctrine says Agile Combat Support is:

> . . . the foundation of global engagement and the linchpin that ties together Air Force distinctive capabilities. It includes the actions taken to create, sustain, and protect aerospace personnel, assets, and capabilities throughout the spectrum of peacetime and wartime military operations. Further, it supports the unique contributions of aerospace power: speed, flexibility, and global reach.[3]

While the ACS CONOPS focuses on Agile Combat Support for employed aerospace forces in a deployed environment, this core Air Force competency also affects processes that are CONUS-based and accomplish organize, train, and equip functions. Specifically, to quote Air Force Doctrine Document 1:

> … although support to contingency operations is absolutely critical to our success as a force, ACS is not just a concept for deployed operations. Every facet of our service must be focused on providing what ultimately is combat support, whether it is better educated warriors, better home-based support for members and their families, better methods to manage our personnel system, or more efficient processes to conduct business—those things that keep our people trained, motivated, and ready. Equally important to a technologically dependent service like our own is agility in our acquisition and modernization processes, which will provide greater warfighting flexibility.[4]

The purpose of the ACS CONOPS is to convey how Agile Combat Support—through its effects, master processes, and capabilities—enables and sustains AEF operational CONOPS in a dynamic environment. To expand on that thought, Agile Combat Support is the ability to sustain flexible and efficient combat operations while providing a highly responsive force support through a seamless and ACS system. Its mission is to create, sustain, and protect all air and space forces across the full spectrum of military operations

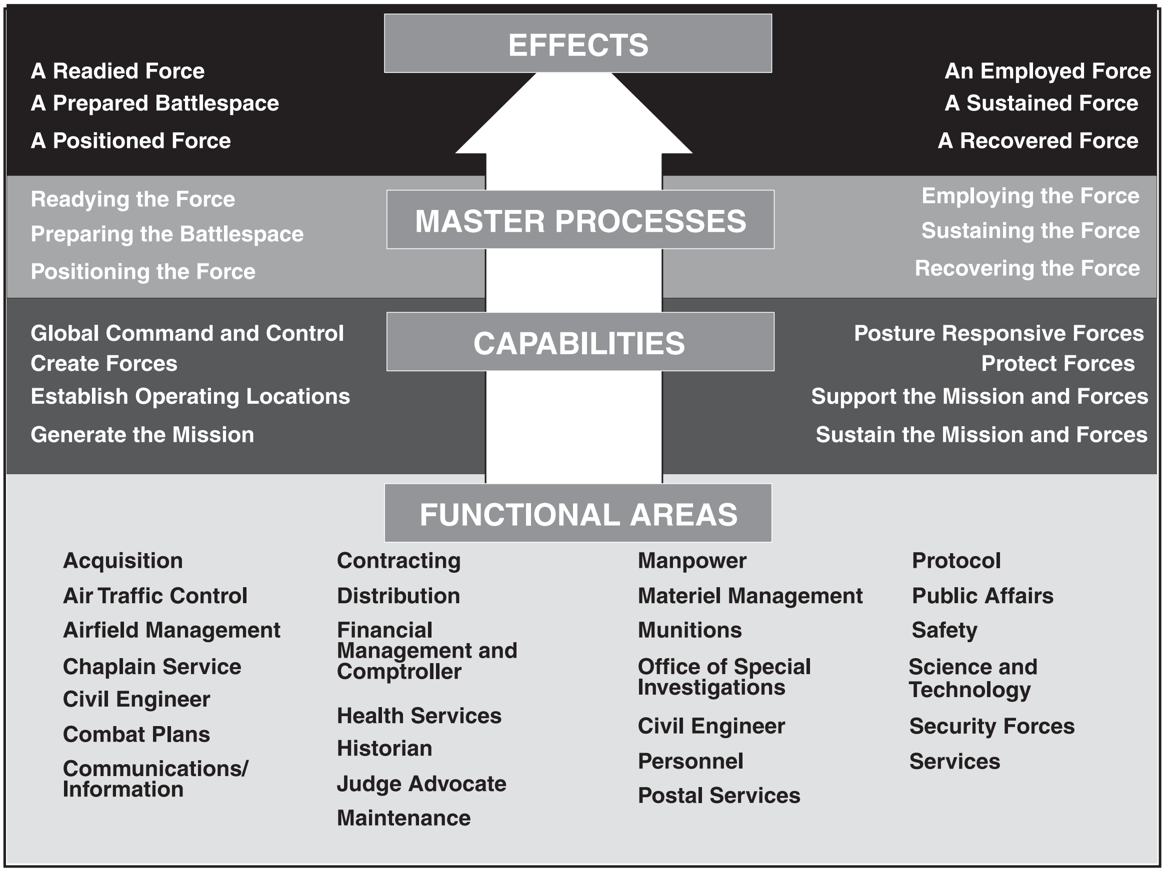


Figure 1. Creating ACS Effects

Agile Combat Support directly supports Focused Logistics and Full Dimension Protection as set forth in Joint Vision 2020. The Chief of Staff established his vision in Air Force Vision 2020: Global Vigilance, Reach, and Power to develop the Air Force role in achieving Joint Vision 2020. This vision continues to express Agile Combat Support as the building block that enables aerospace power to contribute to joint force commander objectives.

The ACS CONOPS also presents a description of how the Air Force integrates effects-based CS capabilities and further provides a framework for evaluating alternatives to doctrine, organizations, training, and technologies. The overarching theme of effects-based capabilities allows the ACS CONOPS to better integrate with the operational concepts.

The concept of Agile Combat Support, by design, provides a platform for speculative and provocative discussion about future AEF concepts and capabilities. Figure 1 graphically shows the complicated interrelationship between the functional areas, master processes, and ACS capabilities and effects and how these support the combatant commander. The ACS CONOPS horizontally integrates 26 functional areas key to AEF operations. Each is part of and critical to the master processes that produce ACS capabilities, these capabilities being to create forces, command and control, establish operating locations, protect forces, posture responsive forces, generate the mission, support the mission and forces, and sustain the mission and forces.

The ACS CONOPS is an incubator for transformational capabilities key to delivering ACS to the combatant commander. It is an evolving document and, as such, will continue to respond to unprecedented reform in military roles and missions, the challenges of increased uncertainty in the international security arena, and significant reductions in resources. As a result of these challenges, the Air Force is realigning its organizations, doctrine, and training to decisively establish itself as an expeditionary air force. The entire Air Force has felt the effects of this realignment, and expeditionary CS activities have been heavily impacted. AEFs are operating simultaneously from widely separated locations around the world, placing strong demands on CS activities and resources. This dictates that we devise new ways of doing business with new or enhanced capabilities.

Meeting these challenges requires a fundamental redesign of ACS command and control. The time has arrived to transform ACS command and control so it is effects-based and capability-enabled. We need an ACS C2 enterprise that is highly mobile, technologically superior, robust, responsive, flexible, and fully integrated with operational capabilities. The ACS CONOPS, with its discussion of ACS command and control, embodies this effort. ACS command and control is the keystone capability to establish effective integration of operations and ACS functions and force multipliers to achieve viable support capabilities for multiple operations worldwide in the face of increasing requirements and decreasing resources. The combined effect of ACS capabilities is that which we deliver to the combatant commander: mission capable, combat air and space forces.

Notes

1. Maj Gen David A. Deptula, *"Air Force Transformation: Past Present, and Future,"* Aerospace Power Journal, Fall 2001 [Online] Available: http://www.airpower.maxwell.af.mil/airchronicles/apj/apj01/fal01/phifal01.html.
2. Dr James G. Roche, Secretary of the Air Force Remarks for the activation of the 116th Air Control Wing, Robins AFB, Georgia, 30 Sep 02 [Online] Available:.http://www.af.mil/news/speech/current/sph2002_15.html.
3. Air Force Doctrine Document 1, *Basic Doctrine*, Air Force Doctrine Center, Maxwell AFB, Alabama, Sep 97.
4. AFDD 2-4, Combat Support, Draft, Air Force Doctrine Center, Maxwell AFB, Alabama, 2003.

Colonel Morrow is Chief, Planning, Doctrine, and Wargames Division, Directorate of Logistics Readiness, Air Force Installations and Logistics. Ms Battles is employed by Synergy and supports the Doctrine and Wargames Division, Directorate of Logistics Readiness, Air Force Installations and Logistics.

We need to capture and incorporate combat support lessons learned from recent operations.

Doctrine and Combat Support C2

Lieutenant Colonel John Richards, USAF

The combat support command and control (CSC2) operational architecture report[1] highlights the importance of doctrine in establishing an effective command and control (C2) structure. Sound guidance on command and control is especially important in the area of combat support (CS) because responsibilities typically cross between combatant command and service chains of command and usually extend beyond the borders of the combatant commander's theater. Our existing CS doctrine is extremely thin, especially in the area of command and control, and needs a complete overhaul.

Joint Publication 1-02, *DOD Dictionary of Military and Associated Terms*, defines doctrine as "fundamental principles by which military forces or elements thereof guide their actions in support of national objectives." Doctrine allows us to provide our warfighters with knowledge on how best to employ air and space forces by providing them with distilled insights and wisdom gained from experience in warfare and other military operations.[2] Doctrine is similar to policy in that it provides guidance to the warfighter on how to accomplish the mission, but unlike policy, doctrine does not mandate compliance with a specific process or practice. Doctrine allows the warfighter the flexibility to deviate as circumstances dictate. While policy is often written to ensure compliance with law, international agreement, or convention; specify standardization for efficiency or effectiveness; or ensure safety, doctrine is written to guide our warfighters' actions so they do not have to relearn lessons with each successive operation.

In the CS arena, a review of lessons learned from Operation Desert Storm to Operation Enduring Freedom indicates that, in many areas, we have failed to learn from past experience. In part, that is due to a lack of adequate CS doctrine. We have not done an effective job of translating lessons learned into doctrine, which leads us to repeat our mistakes or fail to pass on our successes from one operation to the next. To improve CS doctrine, we must institutionalize a process that allows us to capture lessons learned; test potential solutions to identified problems and successful innovations through wargames, experiments, exercises, or field tests; and then translate concepts that can be implemented into doctrine. This is especially true in the area of CSC2.

CSC2 is one of the least documented, least understood, yet most critical areas of combat support. The requirement for services to provide organized, trained, and equipped forces to the combatant commanders and[3] sustain those forces extends into the theater in both peacetime and war.[4] With the move to reduce the forward footprint and transition to a distribution-based vice inventory-based sustainment system, deployed forces are much more reliant on reachback to support outside the theater than ever before. Clearly defined C2 roles and responsibilities for combat support have become absolutely critical to the combatant commander's effective execution of the mission. Yet, as the CSC2 operational architecture report shows, Air Force doctrine on CSC2 is almost nonexistent.

At the fall 2001 Air Force Installations and Logistics/Major Command (MAJCOM) Directors of Logistics Conference, our senior logistics leaders reviewed Air Force Doctrine Document (AFDD) 2-4, *Combat Support*, and decided that a major overhaul was overdue. With the publication of AFDD 2-4 three years before, Air Force CS processes had undergone significant transformation that needed to be incorporated into doctrine. The original publication included little in the way of useful guidance for engaged forces and contained almost nothing about the tasks, capabilities, and effects of combat support. In coordination with the Air Force Doctrine Center, Air Force Installations and Logistics and MAJCOMs initiated a major revision of AFDD 2-4 in January 2002. Subsequently, all subordinate doctrine documents[5] to AFDD 2-4 have been opened for revision by the Air Force Doctrine Center, while a new document, AFDD 2-4.5, *Legal Support*, has just been published. However, with the execution of Enduring Freedom and Iraqi Freedom and development of the Chief of Staff's six operational concepts of operation,[6] the knowledge gap has grown even wider.

While we have made a good start on identifying problems with current CS doctrine and have made some inroads into rewriting existing documents in the 2-4 series, much work remains to be done. We need to capture and incorporate the lessons learned from recent operations. We need to capture and incorporate transformational concepts now being implemented. And we need to expand and improve CS information in critical documents outside the AFDD 2-4 series such as AFDD 2, *Organization and Employment of Aerospace Power*, and AFDD 2-8, *Command and Control*.

Notes

1. James A. Leftwich; Amanda Geller; David Johansen; Tom LaTourrette; Patrick Mills; C. Robert Roll, Jr; Robert Tripp; and Cauley von Hoffman, *Supporting Expeditionary Aerospace Forces: An Operational Architecture for Combat Support Execution Planning and Control*, RAND, MR-1536-AF, 2002
2. Joint Pub 1, *Joint Warfare of the Armed Forces of the United States*, Department of Defense, Washington DC, 14 Nov 00.
3. Joint Pub 0-2, *Unified Action Armed Forces*, Department of Defense, Washington DC, 10 Jul 01.
4. Joint Pub 4-0, *Doctrine for Logistics Support of Joint Operations*, 6 Apr 00.
5. AFDD 2-4.1, *Force Protection*, AFDD 2-4.2, *Health Services*; AFDD 2-4.3, *Education and Training*; AFDD 2-4.4, Bases Infrastructure and Facilities.
6. Global Strike, Global Response, Homeland Security, Global Mobility, Nuclear Response, Space and C4ISR.

Colonel Richards is Deputy Chief, Planning, Doctrine, and Wargames Division, Logistics Readiness Directorate, Air Force Installations and Logistics.

(CSC2 Nodes continued from page 29)

Notes

1. James A. Leftwich; Amanda Geller; David Johansen; Tom LaTourrette; Patrick Mills; C. Robert Roll, Jr; Robert Tripp; Cauley von Hoffman, *Supporting Expeditionary Aerospace Forces: An Operational Architecture for Combat Support Execution Planning and Control*, RAND, MR-1536-AF, 2002.
2. The Air Force is implementing several of these actions. See Maj Gen Sullivan's article on page 6of this edition of the *Air Force Journal of Logistics* for more information on the specific implementation plan.
3. AFDD 2-8, Command and Control, 16 Feb 01, 31.

Dr Tripp is a senior analyst at RAND. Dr Roll is Director, Resource Management Program, Project Air Force. At the time of this study, Major Von Hoffman was Deputy Chief, Maintenance and Munitions Division, Air Force Logistics Management Agency.

(C2 in the CIRF Test continued from page 37)

support center, as described in the CSC2 operational architecture.

15. Further information on the RAND model and analysis is contained in Geller, et al.
16. Article in *The Exceptional Release*, Logistics Officer Association Magazine, Spring 2002.
17. More discussion about organizational roles needed to support the CSC2 operational architecture can be found in "Combat Support C2 Nodes: Major Responsibilities," page 22 of this edition of the *Air Force Journal of Logistics*.

Dr Tripp and Dr Amouzegar are senior analysts at RAND. Ms Geller is a RAND adjunct staff member. Mr Drew is a research analyst at Rand.

EXPLORING THE HEART OF LOGISTICS

Innovations and Transformations

Grover Dunn

George W. Bush's speech at the Citadel in September 1999 introduced his position on defense operations and policies. He said, "Even the highest morale is eventually undermined by back-to-back deployments, poor pay, shortages of spare parts and equipment, and rapidly declining readiness."

In Dick Chaney's Republican National Convention speech in August 2000, he said, "Rarely has so much been demanded of our armed forces and so little given to them in return. And I can promise them now, help is on the way."

These and other statements prompted all US military branches to take action. When Donald Rumsfeld testified before the Senate Armed Services Committee in June 2001, he expressed his recognition of the magnitude of the problem, by saying, "We have under invested in dealing with future risks. We have failed to invest adequately in the advanced military technologies we will need to meet the emerging threats of the new century." Placed in the forefront of addressing advanced military technologies needed for the emerging new century, the Air Force aims higher than ever before. Starting with initiatives formed in the Spares Campaign, then Depot Maintenance and Reengineering Transformation (DMRT), the Air Force now brings those efforts together in the Directorate of Innovation and Transformation.[1]

In December 2002, the Air Force requested a group of senior retired military officials and industry experts (Red Team) to evaluate the Spares Campaign and DMRT progress, provide an assessment of the initiative implementation plans, identify gaps, develop specific recommendations to enhance successful implementation, and maximize the return on investment. The vast array of initiatives and progress to date impressed the Red Team. However, they identified risks involved with such a wide assortment of initiatives being executed in a decentralized fashion. The Red Team recommended combining a number of transformation efforts into a single entity.

Secretary of the Air Force, Directorate of Public Affairs Press Release No 0225034, 25 February 2003, introduced a new directorate. Under the Deputy Chief of Staff, Installations and Logistics, the Directorate of Innovation and Transformation was created. Grover Dunn, former Deputy Director of Maintenance, will serve as director.

Innovation and Transformation consolidates the Air Force logistics communities, logistics transformation, and enabling technology transformation and reengineering efforts into a single directorate. The directorate will facilitate a more coordinated and integrated move toward Air Force transformation. It will develop and implement Air Force policy and planning for all installations and logistics transformation. Innovation and Transformation will provide leadership and drive change management throughout the design, implementation, and sustainment phases of logistics transformation. The directorate will have two divisions: the Innovation and Transformation Division and Information Technology Division

The Innovation and Transformation Division will plan and develop Air Force installation and logistics transformation concepts for implementation and execution. It also will integrate maintenance, financial management, information technology, planning, spares command and control, and purchasing and supply chain management initiatives for improved warfighter parts supportability and reduced ownership costs.

The Information Technology Division will provide management and oversight of installations and logistics information systems. The division leads the Air Force effort to fully integrate and exploit service and joint information systems. It is the focal point for forecasting, programming, and executing resources for logistics information systems.

Currently, the Innovation and Information team is focusing its efforts on consolidating some initiatives into a more enterprise approach, cutting across functional and organizational boundaries and closing out or transitioning completed Spares Campaign and DMRT initiatives. A change team has been developed to drive a deeper level of program understanding and also develop a risk-mitigation program supporting the Air Force throughout this transformation. Transformation within the Air Force requires extensive cooperation across the entire organization. These efforts will dramatically change the way the Air Force conducts business in the future.

Creating the Directorate of Innovation and Transformation represents a new commitment level within the Air Force, taking bold steps to improve current processes and leverage technology to provide better warfighter support. It also represents a transformation approach transcending functional and organizational boundaries, and addressing processes and systems used throughout the Air Force.

For more information on initiatives, upcoming events, and the latest implementation milestones, please log onto the Spares Campaign Web site, www.il.hq.af.mil/il-i.

Notes

1. For more information on the Spares Campaign and DMRT, please see the *Air Force Journal of Logistics*, Vol XXV, No 4, Winter 2001, and Vol XXVI, No 3.

Mr Dunn is Director, Innovations and Transformations, Air Force Installations and Logistics.

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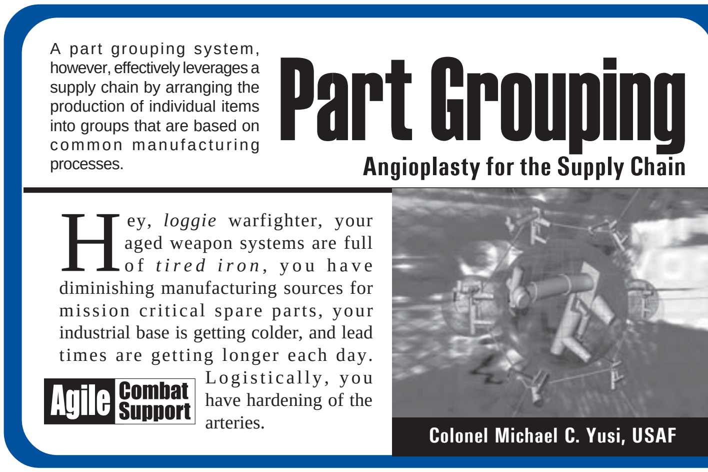


A part grouping system, however, effectively leverages a supply chain by arranging the production of individual items into groups that are based on common manufacturing processes.

Part Grouping

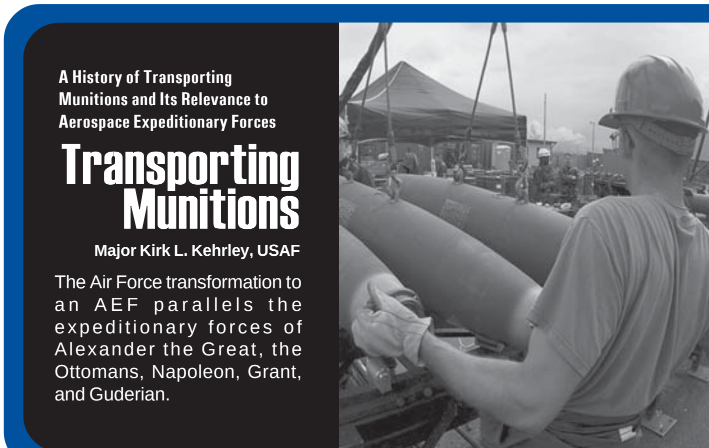
Angioplasty for the Supply Chain

Hey, *loggie* warfighter, your aged weapon systems are full of *tired iron*, you have diminishing manufacturing sources for mission critical spare parts, your industrial base is getting colder, and lead times are getting longer each day. Logistically, you have hardening of the arteries.

Agile Combat Support

Colonel Michael C. Yusi, USAF

The Editorial Advisory Board selected "Part Grouping"—written by Colonel Michael C. Yusi, USAF—as the most significant article to appear in the *Air Force Journal of Logistics,* Vol XXVII, No 1.



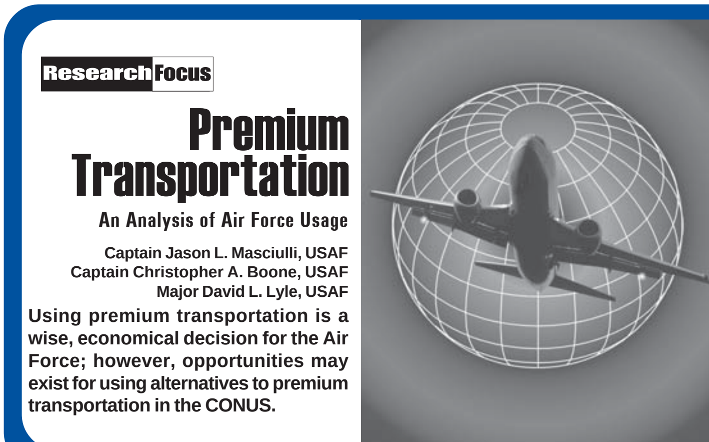
A History of Transporting Munitions and Its Relevance to Aerospace Expeditionary Forces

Transporting Munitions

Major Kirk L. Kehrley, USAF

The Air Force transformation to an AEF parallels the expeditionary forces of Alexander the Great, the Ottomans, Napoleon, Grant, and Guderian.

The Air Force Historical Foundation selected "Transporting Munitions"—written by Major Kirk L. Kehrley, USAF, Vol XXVI, No 3—as the best article containing logistics lessons learned to appear in the *Air Force Journal of Logistics* in 2002.



ResearchFocus

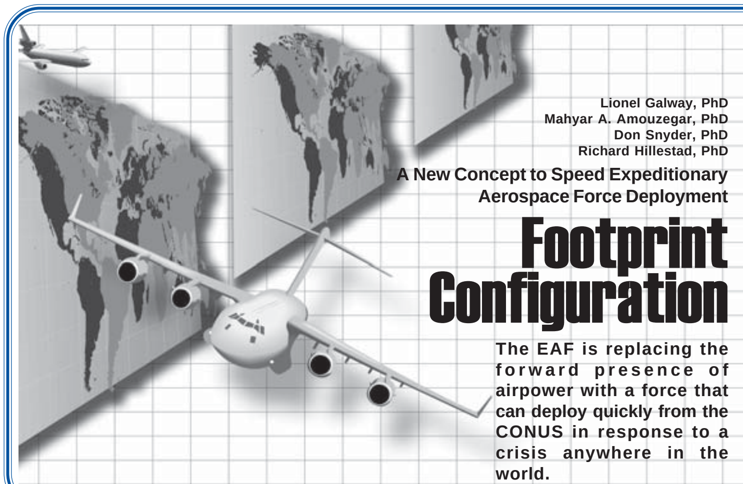
Premium Transportation

An Analysis of Air Force Usage

Captain Jason L. Masciulli, USAF
Captain Christopher A. Boone, USAF
Major David L. Lyle, USAF

Using premium transportation is a wise, economical decision for the Air Force; however, opportunities may exist for using alternatives to premium transportation in the CONUS.

SOLE—The International Society of Logistics Engineers, Montgomery, Alabama—selected "Premium Transportation"—written by Captain Jason L. Masciulli, USAF; Captain Christopher A. Boone, USAF; and Major David L. Lyle, USAF, Vol XXVI, No 2—as the best article written by a junior officer to appear in the *Air Force Journal of Logistics* in 2002.



Lionel Galway, PhD
Mahyar A. Amouzegar, PhD
Don Snyder, PhD
Richard Hillestad, PhD

A New Concept to Speed Expeditionary Aerospace Force Deployment

Footprint Configuration

The EAF is replacing the forward presence of airpower with a force that can deploy quickly from the CONUS in response to a crisis anywhere in the world.

The Editorial Advisory Board selected "Footprint Configuration"—written by Lionel Galway, PhD, Mahyar A. Amouzegar, PhD, Don Snyder, PhD, and Richard Hillestad, PhD—Vol XXVI, No 4—as the most significant article to appear in the *Air Force Journal of Logistics* in 2002.